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Francis Rigby Brodbelt M.D.

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THE

A N A T O M Y

OF THE

ABSORBING VESSELS

OF THE

HUMAN BODY.

BY

WILLIAM CRUIKSHANK.

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THIS Publication conſiſts of two Parts.

PART FIRST, contains

The Hiſtory, Structure, and Properties of the Abſorbing Veſſels, and their Glands, in thoſe Animals in general in whom they have yet been found.

PART SECOND, contains

The Situation and Number of the Abſorbent Glands, and the particular Diſtribution of the Veſſels, in the human Body.

ERRATA.

Page 16, line 7, *for* κορ☉ *read* κορ☉.

Page 52, line 5, *for* not *read* any where.

Page 67, line 17, *for* Marchellis *read* Marchettis.

Page 167, line 19, *for* ſuſpenſatory *read* ſuſpenſory—*and wherever after this word occurs ſo ſpelt.*

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INTRO-

INTRODUCTION.

ABOUT an hundred and ſixty years ago, Aſellius, an Italian anatomiſt, accidentally diſcovered a new ſpecies of veſſels, on the inteſtines of a dog: he afterwards found ſimilar veſſels on the inteſtines of horſes, and other quadrupeds; and, from analogy, ſuppoſed they exiſted alſo in men. Before his time, anatomiſts reckoned three ſpecies of veſſels in men and quadrupeds; arteries, veins, and nerves. The new veſſels were of courſe deſcribed as a *quartum genus vaſorum*. The diſcoverer of theſe veſſels not only perceived that they were a new ſpecies of veſſels, but, obſerving that they contained the ſame kind of white fluid which was contained in the cavity of the inteſtines, he was alſo led to their uſe; and aſſerted, that they took up the chyle from the inteſtines, and carried it to the liver, where, he imagined, it was converted into blood. He named theſe new veſſels *venæ lacteæ*. Theſe veſſels were ſoon after diſcovered in men; but in them, as well as in quadrupeds, were ſuppoſed to exiſt only on the inteſtines and meſentery. Similar veſſels, however, were ſoon diſcovered in other parts of the body, both in men and quadrupeds; but as they contained a watery, and not a white fluid, they were imagined to be different, and of courſe obtained a different name: they were termed, generally, *vaſa lymphatica*.

The lacteals, it was admitted, aroſe from the internal ſurface of the inteſtines, and were not connected with arteries or veins; but Bartholin, one of the diſcoverers of the lymphatics, taught, and the generality of anatomiſts believed, that they were continued from the arteries, and ſerved the purpoſe of carrying back the watery part of the blood to

 the

the heart; but their aſſertions were vague, unaccompanied with experiments, and unſupported by any ſtrong arguments. Some of the more eminent anatomiſts ſuſpected this doctrine, and aſſerted, that the lymphatics alſo abſorbed from ſurfaces. The late Dr. Hunter, particularly, taught this, and urged the following arguments in its favour:—The lacteals ariſe from the ſurfaces of the inteſtines, paſs through the conglobate glands, terminate in the thoracic duct, and are, beyond diſpute, abſorbents. Now, ſaid he, the lymphatics reſemble the lacteals in a number of circumſtances:—Their coats are equally thin and tranſparent; they are equally crowded with valves, for which no good reaſon can be given, ſuppoſing them to be continued, as has been imagined, from arteries; they alſo paſs through conglobate glands; they alſo, like the lacteals, appear to have no connection with arteries, for they cannot be injected from them, as the red veins can; they alſo terminate, at laſt, in the ſame common trunk with the lacteals, the thoracic duct; and, laſtly, they too, appear to riſe from ſurfaces; for if the venereal poiſon is applied to the ſurface of an ulcer, and paſſes into the blood, it paſſes through the lymphatic veſſels, it ſometimes inflames their coats, and makes them, in conſequence of this, appear in the form of red lines; it frequently inflames the glands through which they paſs, and, ſome time after, ſhews itſelf in the conſtitution, by ſymptoms peculiar to itſelf: on the contrary, if ſuch inflamed glands are preſently extirpated, the poiſon is removed with them, and the conſtitution will be prevented from being infected. He farther obſerved, that when injections thrown into the arteries or veins, from rupture of the veſſels, were extravaſated, they got into the cellular membrane, and very commonly from thence into the lymphatic veſſels; or if a tube, loaded with quickſilver, was puſhed, at random, into the cellular ſubſtance of a gland (the teſticle, for example) the quickſilver would frequently paſs into the abſorbents of that part. The venereal and other poiſons paſſing into the lymphatics from the ſkin, proved their origin from ſurfaces; and the extravaſated injections paſſing into the ſame veſſels, from the cellular membrane, proved, in his opinion, their origin from cells. Thus, a grand ſyſtem for abſorption, in men and quadrupeds, was formed, and the lacteals and lymphatics were blended, under the common name of *abſorbents*.

Dr.

Dr. Hunter enjoyed the honour of this diſcovery for many years. At firſt profeſſor Monro was his only rival. The medical world were not always certain to which of theſe gentlemen the credit was due; but there were no doubts that one of the two was certainly entitled to it. Dr. Hunter, in his Medical Commentaries, ſupported his claim ſo well, that the greater part of thoſe who were entitled to hold any opinion on the ſubject, were on his ſide. Lately, attempts have been made to wreſt this diſcovery from Dr. Hunter, and to give it to others. The ſame fate happened to Harvey, and happens to diſcoverers in general. When Harvey diſcovered the circulation of the blood, his opponents firſt attempted to prove that he was miſtaken; but finding this ground untenable, they then aſſerted that it was known long before; Servetus, Columbus, and Ceſalpinus, all knew it: and when they were informed, that if theſe gentlemen did know any thing of the matter, the world at large were totally ignorant of the fact, and likely to have continued ſo, except for Harvey, they once more ſhifted their ground, and ſaid the diſcovery was of no uſe. The name of Harvey, however, at preſent remains in full poſſeſſion of his diſcovery; nor is there the ſmalleſt probability of his ever loſing his title.—Objections were made, and ſtill are made, to Dr. Hunter's theory. It was ſaid, that the lacteals and lymphatics cannot alone form the abſorbent ſyſtem. In the firſt place, Hippocrates and Galen have aſſerted the abſorption by red veins, and their authority has been deſervedly reſpected. 2. Experiments made on purpoſe, by the moderns, are alleged, in confirmation of this abſorption by red veins: they have imagined that they have proved that the veins ariſe from ſurfaces, by open mouths; for which ſtructure no good reaſon can be given, unleſs they are abſorbents. 3. Chyle has been ſuppoſed to have been actually ſeen in the veins of the inteſtines; it could not be there unleſs they had abſorbed it: and if veins abſorb on the meſentery, they muſt abſorb every where elſe. 4. It is alleged, that there are parts of the human body, where no lymphatics are to be found. 5. The lymphatics which have been found, are not ſufficiently numerous to be capable of performing ſo important an office as abſorption. 6. It was alſo ſaid, that there are no lymphatics in amphibious animals, in birds, and in fiſhes; abſorption, therefore, in them, muſt be performed by the red veins: but if red veins abſorb in any of the claſſes of animals,

it is more than probable they alſo abſorb in the human body; the Author of Nature never could have formed two ſets of veſſels to do the ſame thing.

To obviate all theſe and ſome other objections, was Dr. Hunter's intention in projecting this work. In ſome part or other, they will be ſeverally replied to. Mean time, I have choſen to quote a paſſage from his introductory lectures to his courſe of anatomy, lately made public; partly, becauſe it explains the intention of the work; partly, becauſe the different aſſiſtants he had in collecting materials for it, are there mentioned; and partly, becauſe it will explain how I come to be employed in compoſing it.

"In our own times, after ſchools of anatomy have long flouriſhed, in all the civilized nations of Europe, and when, from the number of men employed in ſuch reſearches, it might have been imagined, that diſcoveries were exhauſted, Providence has allowed me a greater ſhare of that ſort of honour, which is generally given to diſcoverers, than I could have expected.

"I think I have proved, that the lymphatic veſſels are the abſorbing veſſels, all over the body; that they are the ſame as the lacteals; and that theſe, all together, with the thoracic duct, conſtitute one great and general ſyſtem, diſperſed through the whole body, for abſorption; that this ſyſtem, only, does abſorb, and not the veins; that it ſerves to take up and convey whatever is to make, or to be mixed with, the blood, from the ſkin, from the inteſtinal canal, and from all the internal cavities or ſurfaces whatever. This diſcovery gains credit daily, both at home and abroad, to ſuch a degree, that I believe we may now ſay, it is almoſt univerſally adopted: and, if we miſtake not, in a proper time it will be allowed to be the greateſt diſcovery, both in phyſiology and in pathology, that anatomy has ſuggeſted ſince the diſcovery of the circulation!—The anatomiſts of all Europe, for a hundred years, in the moſt improved ſtate of our art, from all their enquiries, were of opinion, that the lymphatic ſyſtem was wanting in birds and fiſhes. But, having found out the importance of the abſorbent ſyſtem, in man and in all quadrupeds, we could not reſt ſatisfied that it was wanting in the other two great claſſes of animals; and kept that

object, and every thing which could throw light upon the abſorbent ſyſtem, conſtantly in view.

" Accordingly, my brother, Mr. John Hunter, whom I bred to practical anatomy, and who worked for me, and attended my diſſecting room, and read ſome lectures for me, many years, found ſome lymphatics, firſt in birds, and then in a crocodile.

" Next, Mr. Hewſon, whom I bred to anatomy, and then took into my houſe to work for me, and under my direction, in practical anatomy, to attend my diſſecting room, and read ſome lectures, as my partner, which he did for a number of years; Mr. Hewſon, I ſay, by a continued courſe of obſervations and experiments made in this houſe, diſcovered, and fully demonſtrated, the lymphatics and lacteals, both in birds and fiſhes; which confirmed the uſe and importance of the abſorbent ſyſtem in the human body, and, in comparative anatomy, was one of the greateſt improvements which could have been made, to eſtabliſh the univerſality of Nature's laws in animal bodies.

" And, laſt of all, Mr. Cruikſhank, whom I likewiſe bred to anatomy, and took into my houſe, upon the ſame plan, with the opportunities he had in this place, and by being particularly attentive to the lymphatic ſyſtem, at my deſire, has traced the ramifications of that ſyſtem in almoſt every part of the body; and from his diſſections figures have been made, which, with what I had before, will enable us to publiſh, we hope, in a little time, a full account of the whole ſyſtem, illuſtrated by accurate engravings."

In conſequence of Dr. Hunter's death, and at the deſire of his truſtees, this buſineſs has now fallen on me. I ſhould have had no ſmall ſhare in it, if he had lived; for I had made almoſt all the preparations, from which the drawings were made, and from which the deſcription would then have been, and ſtill is, taken.

The deſcription I have here given of the abſorbent veſſels, is nearly the ſame with that which I have given in public, in the anatomical lectures in Windmill Street, for theſe ten or twelve years paſt. There I not only ſhewed the gentlemen who attended, ſuch parts of the ſyſtem as I occaſionally diſcovered, but alſo in what manner I ſucceeded in detecting them, and how they would be able to ſucceed themſelves. How

far

far others have been indebted to me for their deſcriptions, will appear by comparing them with this work.

In the preſent publication, we have more reaſons than one to regret the loſs of Dr. Hunter. It has ſo happened, that we ſhall be able to derive no advantage to it from his fortune, which has been otherwiſe diſpoſed of. The work, from this circumſtance, cannot appear at preſent with the number of plates it would have done, had he lived to publiſh it himſelf: we may, perhaps, have alſo ſuſtained conſiderable loſs, in being deprived of his extreme accuracy, good taſte, and unwearied perſeverance.

I meant to exhibit the abſorbents of the whole body in one view. This could not be done from any one ſubject. No body would keep long enough, even in winter, to admit of the neceſſary injections, diſſections, and drawings. It is almoſt impoſſible to inject the abſorbents equally well in every part of one body. It was neceſſary then, in order to exhibit the abſorbents of the whole body in one view, to take whatever had been more ſucceſsfully injected in a variety of bodies, and to combine them together.

With this view I drew the outline of the human body of the ordinary ſize. On the trunk of the body I alſo drew the outline of the principal viſcera of the thorax and abdomen. The lymphatics were then put in their reſpective places, alſo of the natural ſize. When the whole was finiſhed, the annexed figure was reduced to its preſent ſtate, and the proportions every where accurately preſerved. When the abſorbents on the extremities are repreſented by continued lines, it is to be underſtood that they are then ſuperficial; that is, immediately under the ſkin, on the extremities; and immediately under the peritoneum or pleura, or ſome analogous membrane, on the viſcera. When they are repreſented by dotted lines, it is to be underſtood that they are on the poſterior ſide on the extremities. In this I have not taken an unprecedented liberty with my ſubject: the great Albinus informs us, that he conſtructed his muſcular figures preciſely in the ſame way; that in the firſt place he procured a very fine natural ſkeleton, had very accurate drawings made of it, and then, from a variety of ſubjects, he placed the muſcles on it in their relative ſituations: "Sic paratus," ſays he, "et conſilio certiore, et

ſpe

ſpe minus dubia, ad muſculos figuris ſceleti inſcribendos aggredi." And that it was even impoſſible for him to do this, but from a variety of bodies: "Non poteram certe, ex uno eodemque corpore, muſculorum plerorumque figuras conſequi, nedum omnium: imo vero ſatis apparebat, aliquot fore impendendos annos, corporaque adhibenda multa." He farther informs us, that he not only collected from a number of bodies, but that he ſelected what appeared to him the fineſt of its kind: "Corpora adhibita adultorum, eorumque quæ maxime erant idonea: muſculi autem, quales frequentius occurrerant, tales exhibiti, potiſſimumque electi, quos abſolutiores ſimul et laudatiores eſſe licebat exiſtimare." I have done nearly the ſame thing with the lymphatics.—Dr. Hunter's truſtees once propoſed to have engraved and publiſhed all the drawings we had on this ſubject, and to have placed this figure the laſt; ſo that the reader, having ſeen the ſeparate plates, each of which were taken from one body only, and are faithful copies of nature, might better judge of the degree of liberty I had taken in combining them into one; but the expence of engraving induced me to lay before the public what Dr. Hunter and I had done in the abſorbent ſyſtem in one view: and, if they are inclined to encourage the work, the different parts of which the figure is compoſed will appear afterwards ſeparately. Almoſt all the injections, from which the drawings were made, are ſtill preſerved in Windmill Street. The ſame veſſels are never repreſented twice in the ſame limb, or on the ſame viſcus; nor were more than two or three different drawings combined in any one part. The liver, for example, appears more crowded with lymphatics than any other part: the appearance, however, is produced from the combination of two preparations only, in which I had injected theſe veſſels with quickſilver, and from which drawings were made at the time. No where are veſſels repreſented, but ſuch as I had injected with quickſilver: I have ſeen the foot covered with lymphatics, but I have drawn none but thoſe I had injected.

I am ſufficiently aware of the objections which will be made to this figure. Euſtachius, Vieuſſens, and many of the celebrated anatomiſts, have previouſly employed this method; but Haller objects to the making the eye travel over an *inane album*, as he chooſes to call it,

it, *arteriarum, venarum, aut nervorum.* Nevertheleſs, I ſay, that though it is certainly true that veſſels or nerves thus exhibited do not convey ſo good an idea as when ſhewn preciſely in their ſituation, reſpecting parts more commonly known, yet it may give a very good general idea; and, as I have added the outline of the body and viſcera alſo, it will do more than thoſe figures which Haller complains of.—As I found the publication of my diſcoveries in this ſyſtem, every day anticipated by thoſe who originally got them from me, I obtained the conſent of the truſtees, that the work ſhould be thus publiſhed, to do juſtice to Dr. Hunter's intentions, and aſcertain what were my diſcoveries.

THE

THE ANATOMY OF THE ABSORBING VESSELS OF THE HUMAN BODY.

CHAP. I.

Of ABSORPTION *generally.*

BY abſorption in animals is meant, a property in certain veſſels of the body, by which they take up the fluids in which their orifices are immerſed, and propel them forward into the blood-veſſels: theſe veſſels are from this circumſtance termed abſorbents. The power of taking up the fluids into theſe veſſels, may be the ſame with the power of attraction in capillary tubes in dead matter: but the power of propelling forward is a power derived from the life. Many bodies, being porous, will take fluids into them, and allow of their paſſing through them freely every way; and many authors have ſuppoſed the bodies of living animals of this kind, and have called this ſoaking through tranſudation: Boyle calls it *animalium poroſitas.*

Dr. Hunter himſelf believed that certain fluids in the living body got out of veſſels in this way; and that the fluid found on the ſurfaces of

the different viſcera, and in all the internal cavities, was formed by tranſudation of the thinner fluids through the coats of arteries; for he obſerved, that the arteries in the dead body, injected with water till they became quite turgid, in a very little time after became flaccid, having allowed the fluid, as he ſaid, to ſoak through their ſides into the cellular membrane.

Albinus appears to have entertained a ſimilar opinion, and ſuſpected that the perſpired fluids oozed through the coats of the arteries in the ſkin. "Quid ni (ſays he) penetraret per mollia noſtra humida-"que, quum calentis aquæ vapor per durum ſiccumque corium eo "modo penetrat?" Profeſſor Mekel, in the Memoirs of the Academy of Berlin, alſo maintains the doctrine of tranſudation through the cuticle. "Quoique (ſays he) inacceſſible aux vaiſſeaux, ſa nature "eſt pourtant telle qu'il tranſmet le liquide dont il eſt imbu, à-peu-"près comme pourroit le faire un cuir mince humecté."

Haller, in a number of places in his Phyſiology, admits a ſimilar tranſudation of fluids; and ſays the oil ſoaks through the peritoneum, for example, or pleura, and aſſiſts in forming the lubricating fluid of theſe ſurfaces. He believes even that the vapour of the ſubjacent rectum penetrates through the *veſiculæ ſeminales*, and gives the peculiar odour to the ſemen.

I am ſorry to oppoſe ſuch reſpectable authority; but I am of a contrary opinion, and join with Dr. Fordyce in believing all parts of a living body impervious but by veſſels, for the following reaſons:—If fluids get out of veſſels by tranſudation, they may get into them by the ſame means, and the firſt ſtep, at leaſt, in abſorption, might thus depend on an animal poroſity: but this, I am confident, is not true.

In dead bodies the fluids certainly tranſude: the veſſels, in loſing life, loſe the property of confining their fluids. Wherever the contained fluid is ſufficiently coloured, we can eaſily demonſtrate this. Bile, for example, is either brown, yellow, or green; and blood, of a dark red: the firſt tranſudes through the gall-bladder, and tinges the tranſverſe arch of the colon, the duodenum, and pylorus, in ſhort, all the neighbouring parts, of the ſame colour with itſelf; the ſecond alſo tranſudes through the coats of veins, and makes the ſtomach, for example, which is naturally white in the living body, of a dark red.

red. Thin fluids injected into the blood-veſſels, in the dead body, alſo tranſude: glue diſſolved in water, and thrown into the coronary veins, tranſudes into the cavity of the pericardium, and jellying retains the ſhape of that *ſac*; the ſame glue injected into the veins of the pia mater, tranſudes into the ventricles of the brain, and when cold and jellied retains the figure of theſe cavities: but nothing of this kind takes place in living bodies. Suppoſe the cavity of the abdomen, in a living animal, intentionally or accidentally laid open, none of the former examples of tranſudation will be obſerved; the bile will not be found tranſuding through its own capſule, nor tinging the colon or pylorus; the ſtomach will be ſeen perfectly white. Mr. Hunter's experiments on the blood-veſſels of living animals, to be mentioned hereafter, prove that coloured fluids, injected into the veins of the inteſtines, neither eſcaped through orifices opening on ſurfaces, nor tranſuded through their coats. That the fluid found on ſurfaces, is not from tranſudation through the coats of arteries, I am perſuaded, from attending to the following circumſtances:—The ſweat, or the fluid found on the ſurface of the body, and which comes more immediately under our obſervation, is found in greater quantity at one time than another. This increaſe of quantity is evidently connected with greater force in the heart and arteries, propelling the fluids, as we ſee after violent exerciſe. Now theſe facts correſpond better with the theory which ſuppoſes organized orifices, or that the mouths of the exhalent arteries terminate on ſurfaces; for, as the force is greater which propels the fluids, theſe orifices muſt be in proportion diſtended; and the fluid being alſo propelled with greater velocity, we can eaſily conceive how the ſecretion ſhould be encreaſed. On the other hand, that copious cold ſweat which takes place on fainting, appears to depend on the greater relaxation of theſe exhalent orifices permitting the fluids to eſcape: but on the principle of tranſudation, which muſt ſuppoſe the fluid and filtre to be almoſt always in the ſame ſtate, theſe phœnomena are abſolutely inexplicable.

That the oil is fluid in the living body, I allow; but that it tranſudes, I deny. It is contained in cells, from whence it cannot eſcape but by the mouths of abſorbent veſſels; accordingly, it cannot be ſqueezed from one part to another, but maintains invariably certain fixed ſituations in all bodies where it is to be found. Suppoſing oil capable of tranſud-

ing in the living body, then it would follow that the moſt dependant parts of the body would ultimately contain it in the greateſt quantity, as gravity would naturally lead it that way: another conſequence would be, that no part of the body could poſſibly be exempt from oil. But as we know that neither of theſe circumſtances are true, the tranſudation of oil becomes more than improbable. Haller, I obſerve, adduces, as a proof of the tranſudation of oil, the circumſtance of its giving tranſparency to the ſurfaces of dead bones, and even appearing on theſe ſurfaces in a liquid form. But, beſides that this is an inſtance in the dead body, Haller was not aware, that, in order to this tranſudation, which I allow, ſome circumſtances are neceſſary, which can never exiſt in the living body: in the firſt place, the cells containing the fat muſt be previouſly broke down by putrefaction; ſecondly, the watery fluids muſt evaporate, and the bones become dry.

That there is no tranſudation through the cuticle, I am perfectly certain. Veſications from burns or bliſters afford us an opportunity of being convinced of this fact. The fluid may ſometimes be abſorbed by the veſſels on the ſurface of the ſkin, and may thus be ſuſpected to have tranſuded through the cuticle; but more commonly it remains days or weeks, or till it is let out by the ſurgeon's ſciſſars. Even in the dead body, where tranſudation of watery fluids ſo generally takes place, there is no tranſudation through the cuticle. I have kept a portion of the dead body, covered with the ſkin and cuticle, before the fire, for ſix weeks together; it was as little dried as the firſt moment it was placed there; whereas, in one hour, had the cuticle been removed, the ſkin would have become hard, tranſparent, and horny. In ſhort, the intention of nature is juſt the reverſe of what Galen and Profeſſor Mekel imagine: it is to prevent the evaporation of ſuch fluids as are in the cellular membrane, and are immediately in contact with the cuticle; for if theſe evaporate, the cells of the cellular membrane communicating freely with one another all over the body, they would be ſucceeded by fluids behind, and thus an immenſe waſte of fluids would take place. For the ſame reaſon, Nature covers oranges, lemons, and fruit in general, with an analogous membrane: it is equally fine, and has this property at leaſt of the human cuticle, of preventing tranſudation of cellular fluids. Every body may convince

convince themſelves of this fact: by removing this membrane, the fluids quickly evaporate, and the fruit becomes ſhrivelled and dried. In ſhort, nothing appears to me more evident than this fact, that in the living body there is no tranſudation of watery fluids: could it take place, there would be no ſuch diſeaſe as a preternatural collection of fluid in any cavity, no ſuch diſeaſe as dropſy; for, the fluids tranſuding through membranes and cuticle, muſt paſs from one cavity into another; from the thorax, in the *hydrops pectoris*, into the ſubjacent abdomen, and having there formed aſcites, would ſoon tranſude and form œdema of the lower extremities, where, likewiſe, after ſome little time, it would tranſude through the cuticle, and theſe diſeaſes would naturally cure themſelves at laſt. But every body knows, that water may remain long collected in the cheſt without producing dropſy of the belly; and this laſt I have known exiſt years without producing ſwellings of the legs. When ſwellings of the legs have taken place, I have ſeen the cutis diſtended, and ſhining, and hard, for many weeks, without the leaſt mark of tranſudation; nor did the ſwelling ſubſide till the cuticle was ſeparated, till it burſt or was punctured.

As I do not admit of the tranſudation of watery fluids during life, neither do I allow of the penetration, pervading, or tranſudation of ſuch fluids as, on opening the cavities of the body, emit vapour, and are ſometimes odorous and fetid. The muſcles covering the abdomen become ſooner green, ſooner putrid, than other muſcles in the body; and this, with reaſon, has been ſuſpected to ariſe from their lying immediately over the inteſtines, then commonly filled with putrid fluids, or fœtid and volatile vapour; both of which may tranſude after death, and become the cauſe of this ſo much more accelerated putrefaction of theſe muſcles. But nothing like this takes place in the living body; no fœtid vapour of the inteſtines can thus ever enter the blood-veſſels, or pervade the other parts of the body, while life remains: the highly fœtid fluid of a lumbar abſceſs is neither ſenſible to the patient nor the by-ſtanders, till it is opened; the odour of the ſemen is its own peculiar odour, and not, as Haller imagines, from the fœtid air of the rectum pervading the *veſiculæ ſeminales*: nor can I admit, that the peculiar flavour and toughneſs of bull's fleſh, wholly wanting in that of the calf or bullock, ariſes from the odour of the

ſemen

ſemen pervading the whole body. There is not the leaſt reſemblance between the two odours, nor can one poſſibly conceive any affinity between odorous particles in a confined fluid, and rigidity and tenacity in muſcular fibres. Tranſudation, then, does not take place in living bodies; and tranſudation, and even the commencement of abſorption, are perfectly diſtinct.

CHAP. II.

The Ancients ſeem to have known ſomething of the Property of abſorbing in Human Bodies.

THAT the human body inhaled, was the doctrine both of Hippocrates and Galen.

Hippocrates taught, that an inhalation of vapour and fluid took place on the ſurface of the body, as well as an exhalation of ſimilar matter. He aſſerted the ſame thing of all the internal ſurfaces and cavities: we find this doctrine ſummed up in the following words:

" Σαρκες ὁλκοὶ καὶ εκ κοιλίης καὶ ἔξωθεν· δῆλον ἡ ἄισθησις ως εκπνοον καὶ " εισπνοον ὅλον τὸ σωμα."

" The ſoft parts of the body attract matter to themſelves both from " within and from without; a proof that the whole body exhales " and inhales."

One might ſuppoſe that Hippocrates here only meant, by exhaling and inhaling, expiration and inſpiration from the lungs: but he ſays, ὅλον τὸ σωμα, which can never apply to the lungs; and Galen, as we ſhall ſee afterwards, underſtands the word εισπνοον, here uſed by Hippocrates, as ſignifying abſorption. Paſſages in Hippocrates, to be hereafter quoted, will alſo put this matter beyond all doubt. Galen himſelf ſpeaks moſt deciſively of the abſorption in the human body; he, indeed, conceives

conceives it to be by an attraction; but he uſes the ſame word when he deſcribes the veins taking up fluids. His words are:

" Δύο εισιν ὁλκῆς ἴδη τὸ μεν τῇ πρὸς το κενουμενον ἀκολουθία το δε ὁικειό-
" τητι ποιοτητος γιγνὸμενον. ἑτέρως μὲν γὰρ εις τας φὺσας ὁ ἀήρ ετερως δέ ὁ
" σἰδηρος απο της ηρακλειας επισπᾶται λίθου." —— That is,

" There are two kinds of attraction; one which ariſes in conſequence
" of a *vacuum* being formed, and the other from reſemblance in qua-
" lity; for, in one way does the bellows attract air; and in an-
" other way is ſteel attracted by the magnet."

The Arabian phyſicians appear alſo to have been acquainted with this property of abſorbing in the human body; for we find them frequently applying medicines to the ſurface of the ſkin, which were to produce their effects as expectorants on the lungs, as emetics on the ſtomach, as purgatives on the inteſtines, or diuretics on the kidneys. It may here be urged, that this is no proof of their knowing any thing of abſorption. The Chineſe phyſicians, Kempher informs us, frequently apply remedies to one part of the ſurface of the body, which are intended to produce their effects on a diſtant one; but this is on a different principle from abſorption. They have conceived eſtabliſhed connections between ſome parts of the body and certain others; and when they wiſh to produce an effect on a diſeaſed eye, for example, they apply the remedy not to the eye itſelf, but to ſome diſtant part of the body, with which it is particularly connected. As the Greeks, however, appear to have underſtood abſorption, and as the Arabians obtained their medical knowledge from them, it becomes much more probable that the practice mentioned was founded either on a knowledge or belief of the abſorbing property of the human body.

CHAP. III.

The Ancients alſo maintained, that the Inhalation in the Human Body was performed by Veſſels.

HIPPOCRATES and Galen not only aſſerted, that all parts of the body inhaled, they alſo taught that this inhalation was performed by veſſels; that both veins and arteries inhaled.

Καὶ γαρ ἀι φλεβες, ſays Hippocrates, ἀι εκ της νηδυος, καὶ των εντερων, ἐις ἃ ξυλλεγεται τα σιτια, και τα ποτα, επειδὰν θερμανθῇ τᾶυτα, ελκυσι το λεπτοτατον, καὶ το υγρὸτατον, το δε παχυτατον αυτεω καταλείπεται, καὶ γινεται ποπρος, εν τοῖσιν εντεροισι τοισι κατω. ——

"For the veins of the ſtomach and inteſtines, in which our meat "and drink are collected, as ſoon as theſe are heated (digeſted) "attract the thinneſt and moſt liquid part; but the thickeſt part is "left, and becomes *fæces* in the lower part of the inteſtines."

In another place he recommends, after vomiting, the waſhing the mouth with ſome acid wine, in order that the mouths of the veins might be conſtricted, and thus might not take in any of the vomit:

Εκ δε τε ἐμέτε κλύσαι τὸ ςόμα καὶ την φάρυγγα οινω αύςηρῶ, ὅκως αν συςυφῇ τα ςοματα των φλεβῶν καὶ μηδεν επικαταςπασθῇ ὁκοῖα γίνεται απο ἐμέτων.

In the ſame manner Galen aſcribes the abſorption on the ſurface of the body to veins:

Ὡσπερ, ſays he, διὰ των εις το δερμα περαινομενων ςομάτων ἐκρίνεσι μὲν ἔξω πᾶν ὅσον ἀτμῶδες καὶ καπνωδες περιτωμα, μεταλαμβάνεσι δε εις εαυτας εκ τε περιεχοντος ἡμᾶς ἀέρος εκ ολιγην μοῖραν. καὶ τετ' ἔςι το προς Ιπποκρατες λεγομενον ως εκπνεν καὶ εισπνεν ες·ιν ὅλον το σῶμα. ——

"For as the veins, by mouths placed in the ſkin, throw out what-"ever is redundant of vapour or ſmoke; ſo they receive, by the ſame "mouths, no ſmall quantity from the ſurrounding air; and this is "what Hippocrates means, when he ſays, that the whole body ex-"hales and inhales."

It

It alſo appears from Galen, that the ancients believed that the arteries abſorbed as well as the veins; for he ſays:

Ατμον μεν οὖν ἔχουσαι καὶ πνεῦμα καὶ λεπτον αἷμα κατα ταις διαστάσεις ἕλκειν αἱ ἀρτηρίαι του κατα τὴν κοιλίαν καὶ τα ἔντερα περιεχομενον χυμὸν, ἢ οὐδε ὅλως η πανταπασι συνεπισπῶνται ἐραχὶ.

"The arteries, which contain vapour, in their diaſtole attract (abſorb) "air, and the more ſubtile part of the blood; but they do not at all "abſorb the fluid found in the ſtomach and inteſtines, or but very "little."

CHAP. IV.

Experiments inſtituted by the Moderns, with a View to demonſtrate the Venous Abſorption of the Ancients.

I Do not know that the ancients made any experiments which could induce them to believe that veins abſorbed, nor do I know on what foundation their belief reſted. There is one experiment of Eraſiſtratus's, mentioned by Galen, which appears to have given riſe to their doctrine of the arteries abſorbing air and finer fluids: perhaps this might induce them to ſuſpect that the veins too abſorbed. It will appear afterwards, that Eraſiſtratus was, in that experiment, deceived; that they were not arteries, but lacteals, which he ſaw; and that it was not air, but lymph, which they had abſorbed; of courſe, that there was no juſt reaſon for the doctrine of arterial abſorption. The diſcovery of the circulation of the blood demonſtrated that the courſe of the arterial fluids was conſtantly from the centre of the body to the circumference, that is, perfectly oppoſite to that of abſorbed fluids, or ſuch as are ſuppoſed to be paſſing from the circumference to the centre; and this overturned entirely that doctrine.

That they were equally miſtaken in aſſerting the abſorption by red veins, has not been ſo univerſally aſſented to. Swammerdam firſt made experiments to prove their doctrine true; he made ligatures on the meſenteric veins, and having thus intercepted the blood returning from the inteſtines, after waiting ſome time, he opened the veins, and examined the blood: it appeared to him marked with white lines or points, which he concluded was the chyle which the veins had juſt abſorbed from the ſurface of the inteſtines: "Sanguis quandoque velut ſtriatus, et albis lineis permiſtus, quandoque ſeu punctis notatus ipſi apparebat:" And though he knew that there was alſo a white fluid in the lacteals, he would not allow that it was the chyle, but a white lymph which theſe veſſels took up from the glands of the inteſtines: "Ideoque in ea ſum ſententia, non niſi albicantem lympham eſſe, quicquid in lacteis vidimus, et ex glandulis inteſtinorum procedit, quæ ſuccum ſuum ab arteriis accipiunt."—Kaaw Boerhaave, Profeſſor of Medicine at Peterſburgh, and a great admirer of the ancients, informs us, in his book entitled *Perſpiratio dicta Hippocratis*, that he injected water into the ſtomach and inteſtines of a dead dog, and ſaw it return by the veins of thoſe parts, in ſuch quantity as to waſh out the blood they contained, and leave them perfectly white: "Canis poſt mortem ſtatim incidi et aperui thoracem et abdomen; mox per œſophagum, premendo leniter ventriculum, evomere contenta omnia feci. Dein immiſſam puram aquam tepidam, movendo leniſſime ventriculum, vidi a venulis bibulis illam reſorberi, ingredi venas gaſtricas majores, tandem portarum venæ tradi, et ex hac, per hepar, venæ cavæ reddi eandem.—Tædioſo labore, per horas leniſſime immittere aquam et premere ventriculum continuavi, donec pallerent omnia vaſa ſanguine orbata, per reſorptam aquam.—Aqua vel cera, per hæmorrhoidales venas injecta, in inteſtinorum cava exit."

Profeſſor Mekel of Berlin alſo ſupported this doctrine; and in his treatiſe, entitled, *Experimenta nova et Obſervationes de Finibus Venarum*, &c. aſſerts, that the veins open on ſurfaces, in the human body; particularly, that he had injected the veins by coloured wax thrown into the cavities of the *veſiculæ ſeminales*; that he had alſo injected the veins by air and water thrown into the cavity of the bladder of urine from the urethra. "Viri robuſti veſiculas ſeminales, adhuc in pelvi, inter veſicam urinariam

urinariam et intestinum rectum sitas, absque ulla reliquorum vasorum liquida ferentium repletione, per ductum deferentem, ea intentione, ceraceo liquido subtiliori, rubro colore tincto, replevi, ut situm ac figuram earunden naturalem, hocce præparato, in physiologicis meis lectionibus, cuilibet tempore opportuno, monstrare possem. Ne vero in urethram ac vesicam urinariam injectum liquidum prorumperet, frustraretque exspectationem meam, tubulos ejaculatorios caute ligavi. Distentis itaque liquido vesiculis, id quod in aqua tepida perfeci, ne injectio nimis cito coagularetur, venæ hypogastricæ ramos, plexum venarum vesiculas seminales circumdantem formantes, ad majores usque ramos injectione replevi, eamque ex truncis dissectis effluere inexspectato sane spectaculo vidi. Refrigeratis itaque partibus, nil avidius experiri cupiebam, quam quæ hujus singularis phænomeni causa exstiterit. Caute itaque præparatis venis, ad externam vesicularum seminalium superficiem, usque eas plexu minimarum venarum, injectione ceracea rubra turgidarum, ubique tectas inveni, quarum extremitates in cavum vesicularum canalem defixæ hærebant.—Repetitum hoc experimentum non semper mihi successit, sed pluries tamen, periculo in hoc receptaculo seminis per injectionem facto, eventus idem labori respondit.

" In cadavere virili satis robusto, urinæ vias indagaturus, vesicam per urethram inflare conatus, omnis flatus per venas continuo ex vesicæ cavo rediit, ut vesica inflata mox iterum collaberetur. Studiosius in causam hujusmodi phænomeni inquirens, aquam in vesicam per urethram siphonis ope impuli, quæ vero facillime ex vesica in venas plexum vesicæ formantes, et ex his in truncum venæ hypogastricæ, transiit. Interne considerata vesica, nullo villosæ tunicæ vitio laboravit, sed integerrima ac naturaliter constituta fuit, ut itaque viam ex vesica urinaria, fluido vel aeri apertam, per vasorum venosorum ostiola patuisse nullum dubium sit. In aliis, inflando aerem itidem, sed lentius, per vasa ex vesicæ cavo viam sibi in venas quæsivisse repetitis vicibus observavi." The same author informs us, that he saw a white fluid in the veins of the intestines in the dead body : " Lympha alba in venis mesenterii."

Baron Haller is also of the same opinion, and strenuously contends,

that the veins certainly ariſe from ſurfaces by open mouths, and muſt be abſorbents, as the ancients aſſerted.

"Neque raro vidi," ſays he, "cæruleam ichthyocolam, quæ de venis exhalaverat, pericardii figuram expreſſiſſe. Et iterum figuram ventriculorum cerebri glutino piſcium per venas impulſo, non ſemel conſervatam vidi, ut manifeſtum ſit, a venis in eas omnes caveas liberum iter eſſe."

Leiberkun aſſerts, that he ſaw the injection run out of the orifices of the veins, on the villi of the inteſtines.

Arguments have been added to theſe experiments. It has been urged, that veins are confeſſedly allowed, by every anatomiſt, to ariſe by open mouths from the cells of the *corpus ſpongioſum urethræ* and *glans penis*, from ſimilar cells in the *clytoris* and *plexus retiformis* in women, as well as from the cells of the *placenta*. The ſame thing is ſeen in the ſpleen of many quadrupeds. The ingenious Boerhaave has alſo employed two other arguments in ſupport of venal abſorption in the inteſtinal tube: in the firſt place, he aſſerts that the blood of theſe veins, on ſtanding, and in the dead body, either forms no coagulum at all, or a very little one; it would have coagulated in the arteries: it muſt have received ſome addition, ſome mixture muſt have taken place in the cavity of the veins, to have thus deprived it of its uſual property. Secondly, he adduces the ſuperior ſize and capacity of the meſenteric veins, when compared with their correſponding arteries, as a ſtrong argument in favour of their abſorbing from the inteſtines. Why are they ſo much larger, double, triple the ſize of the arteries, if they are not to contain ſomething elſe than the blood brought to them by theſe arteries, eſpecially when the whole of the arterial blood does not come to them, as part is carried into the inteſtines in form of a ſecretion?

CHAP.

CHAP. V.

Experiments demonſtrating that red Veins do not abſorb.

IN conſequence of his great attention to the lacteals and lymphatics, and to anatomical injections in general, Dr. Hunter began very early to doubt of the abſorption by red veins.

"My only doubt," ſays he, "was, whether the veins did or did "not abſorb a certain quantity, eſpecially in the inteſtines.—From "my own obſervations on injections, I ſhould have concluded they "did not, and that there was no paſſage for liquors between an in- "teſtine and the meſenteric veins, otherwiſe than by tranſudation. "But authors of the beſt credit had given ſuch arguments and expe- "riments, that I dared not, even in my own mind, determine the "queſtion."

He does not appear to have been acquainted with the experiments of Thomas Bartholin, one of the firſt diſcoverers of the lymphatics. I find that he had made experiments on the veins of the inteſtines, in living animals, which diſproved venal abſorption there, and made him totally reject it. In the epiſtle in which he finds fault with Harvey for refuſing to admit the exiſtence of the lacteals, he ſays: "Chylus non poteſt venas meſeriacas ingredi, quia nunquam id viſum, nunquam voluit natura, nuſquam patet aditus: revero non intrare hoc experimentum probat. Si ligatus ſit meſentericus ramus, non impeditur chylus, quominus ad lacteas ſenſim inde intumentes tranſeat. At, ligatis lacteis, reſtitat chylus, nec ex ventriculo, aut inteſtinis, aut lactearum oſculis, ulterius progreditur."

Mr. John Hunter poſitively denied the abſorption by red veins, and made a number of experiments on living animals, which, in my opinion, are perfectly concluſive: as they are publiſhed in his brother's Medical Commentaries, I ſhall only give the reſult.

I obſerve, in general, that theſe experiments were made on the inteſtines and meſentery of five different animals; ſeveral experiments were

frequently

frequently made in different parts of the inteſtinal tube, in each animal, at the ſame time. It has been doubted, whether any experiment, which puts an animal to pain, can be depended on; but there cannot be a doubt of their deciſive nature here, for, as the opening the abdomen, wounding the inteſtines, and making ligatures on them, did not hinder, in the ſmalleſt degree, the lacteals from performing their functions, nor the arteries and veins from circulating the blood, not a ſhadow of a reaſon can be given, why the veins did not abſorb, ſuppoſing them capable of this office.

1ſt. After one of the animals had been properly ſecured, and the abdomen opened, portions of the inteſtines were quickly emptied, by preſſure, of their proper contents, and warm milk was injected in their place, and confined by ligatures. The veins belonging to theſe portions of inteſtines were emptied of their blood, by punctures made in their trunks, and prevented from receiving more blood, by ligatures made on the trunks of their correſponding arteries. In this ſtate, the parts were returned into the abdomen; and, by the veins being thus left empty, even a ſmall abſorption of the milk would be detected, as the coats of the veins are ſo thin, that they would have permitted white fluid to appear through their ſides as readily as the red blood; whereas, had the blood been allowed to circulate through the veins, a ſmall abſorption of milk might not, perhaps, be perceived, as mixing with much circulating red fluid. Though I have ſuppoſed that a white fluid, mixed with the blood, might not be eaſily detected, yet, in fact, the admixture of the chyle, in the left ſubclavian vein, is eaſily perceived, and any degree of milkineſs in the ſerum of coagulated blood readily diſcovered by an accuſtomed eye. The parts having remained in the abdomen a quarter of an hour, half an hour, or more, that the natural warmth of the cavity might aſſiſt the natural abſorption, they were again allowed to protrude, and carefully examined: the veins were found nearly as empty as when the parts were firſt returned, and contained not one drop of white fluid; but the lacteals were full of it.

2d. Similar experiments were made on other animals, with this additional circumſtance, that preſſure was made on the portions of inteſtines containing the milk. Kaaw Boerhaave imagined, that he forwarded the abſorption of water, into the veins of the ſtomach, by

 preſſure.

preſſure. Alternate and conſiderable preſſure was here made, even to that degree, that at laſt the inteſtines burſt; and yet not a drop of the milk was found in the veins.

3d. It might be objected, that the veins did not abſorb, becauſe ligatures were made on their trunks: this could be no objection, for the lacteals perſiſt in abſorbing under ſimilar circumſtances. However, that even the ſhadow of an objection might be removed, ſimilar experiments to the former were made, where the arteries and veins were left free, and the blood continued to circulate, during the whole period. After the parts had continued a quarter of an hour in the cavity of the abdomen, they were allowed to protrude again; openings were made in the trunks of the veins, and the blood received in veſſels; but neither the fluid blood, nor the ſerum, after the blood had coagulated, ſhewed the leaſt mixture of milk.

4th. Similar experiments were made with ſtarch diſſolved in water, and coloured blue with indigo. The fluid venal blood did not appear darker in colour; nor did the ſerum of the ſame blood, after it had coagulated, ſhew the leaſt tinge of blue.

5th. One cannot conſider milk, and ſtarch diſſolved in water, as viſcid fluids, not eaſily abſorbed by veins; for the lacteals abſorbed them very readily. In Kaaw Boerhaave's experiments, the veins, however, abſorbed water. Here too a portion of inteſtine, emptied previouſly, was filled with warm water, the trunk of the arteries was tied, yet the correſponding veins never became fuller, nor was there the leaſt appearance of the water having got into the veins.

6th. The eye might be deceived; the ſmell, perhaps, might detect what had eluded the other ſenſe: ſimilar experiments were therefore made, in the inteſtines of other animals, with a ſolution of muſk in water. After a proper period, the venous blood was received into a cup, *per ſaltum*, from an opening made in the trunk of the veins; but it diſcovered not the leaſt ſmell of muſk!

7th. While the portions of the inteſtines were full of the ſtarch, coloured with indigo, warm milk was injected by the trunk of the arteries till it returned by the veins, and for ſome conſiderable time: this milk, received from an opening in the trunk of the veins, ſhewed not the leaſt tinge of blue.

8th. Portions

8th. Portions of the inteſtines were emptied, and by ligatures ſeparated from the general canal; milk was injected by the trunk of the veins, which here have no valves, till it returned by the arteries: the inteſtines, after a continuation of this injection for a conſiderable time, were, on examination, found quite empty.

9th. After one of the animals was dead, the meſenteric veins were inflated with air, which, though a very viſcid fluid, found its way into the cavity of the inteſtines; though milk, injected through the ſame veins, while the animal was alive, could not be forced into the ſame cavity.

Theſe experiments appear to me perfectly concluſive. Haller ſays of them, "Videntur ſuadere, ab inteſtinis in lactea vaſa patulam viam eſſe, non perinde in venas meſentericas;" and a little after adds, "Multum tribuo Cl. Viri experimentis, in quibus candor cum induſtria conjungatur. Sed contrarii alia numeroſa argumenta habemus ut non poſſim a præceptoris (Boerhaave) ſententia recedere." He alſo ſays, that where experiments are directly oppoſite, on the ſame ſubject, he was wont to believe thoſe which affirmed any fact, rather than thoſe which denied it; and his reaſon for doing ſo is, "facilius enim experimento ſucceſſus a caſu aliquo negatur: ſucceſſu vero demonſtrato non facile cauſa alia ejus eventus invenitur, quam ipſa partium fabrica." How far he reaſons well, we ſhall ſee in the ſequel.—Leiberkun's experiments were on the dead body, where tranſudation takes place, and are therefore inconcluſive.

As to Boerhaave's obſervations, already mentioned, it is not true, that the blood of theſe veins does not coagulate: in experiments made on living animals, whoſe vena portarum is in every reſpect ſimilar to the human, I have always ſeen it coagulate; nor can I conceive how this error ſhould have become ſo general. Again, what could theſe veins abſorb from the inteſtines, which would prevent their blood from coagulating? The chyle could have no ſuch effect; the lymph could not do this; theſe are coagulating fluids themſelves, and would rather increaſe than diminiſh the craſſamentum of the blood. The next argument adduced by Boerhaave, is founded on the ſuperior ſize of theſe veins to their correſponding arteries—Why are the veins ſo much larger, double, or triple the ſize of the arteries, when they are not even to

carry

carry back the whole blood of the arteries; for part of this goes off, by ſecretion, into the inteſtines? To this it may be replied, that the appearance of the veins in the dead body proves nothing reſpecting their relative ſize in the living body: almoſt the whole blood of the body is then accumulated in them; they contain not only their own proportion of blood, but that alſo which was contained in the arteries. In the next place, the blood in the veins, in the living body, is ſubject to frequent retardation, on ſneezing, coughing, ſtraining, or any great effort; and they are thus much dilated beyond what they were originally. If they had not been larger, theſe retardations would have more frequently ruptured them. Beſides, the ſtate of the blood in the veins is liable to greater variation than that in arteries. The cutaneous veins are turgid in ſummer, and almoſt totally contracted in winter, ſo as not to contain the twenty-fifth part of blood in the one caſe as they do in the other. The velocity of the arterial blood being greater than that of the venous*, it was alſo neceſſary, on that account, that the veins ſhould be larger, even without any ſuppoſed abſorption of fluids by them.—Red veins, then, do not abſorb on the inteſtines and meſentery in quadrupeds; and every thing we have obſerved in the correſponding parts, in the human body, lead us to the ſame concluſions. We have there too ſeen the lacteals repeatedly turgid with chyle; but I never ſaw, on ſuch occaſions, the leaſt mixture of chyle, or tinge of white fluid, in the blood of the meſenteric veins. I mentioned, in the laſt chapter, Swammerdam's having ſeen the blood in the meſenteric veins ſtreaked white. I alſo mentioned, that Profeſſor Mekel informed us, that he had ſeen white lymph in the ſame veins. I have frequently ſeen this appearance in the veins of the inteſtines: what this is owing to, I do not know; it cannot be abſorption of chyle from the cavity of the inteſtines, for then the lacteals would alſo be found to contain the ſame coloured fluid. But, on every occaſion, where I have ſeen this appearance in the veins, the lacteals were conſtantly empty. When blood has been taken from the veins of the arm, the ſerum has been found frequently white as milk. It has continued in this ſtate for months, in the ſame patient; and at laſt recovered its natural colour, without our being able to aſſign any good reaſon for the

* By Dr. Hales' experiments, the force of the motion in the arteries to that in the veins, is as ſixteen to one, nearly.

one change or for the other. Some hours after a full meal, blood, taken from the veins of the arm, has appeared ſtreaked with white lines, which we know is from the chyle, which was poured into them by the thoracic duct; but is no proof of theſe veins having abſorbed chyle from the inteſtines. As the red veins then do not abſorb on the inteſtines, it is not probable, nor does it appear, that they abſorb any where elſe. The appearances which Kaaw Boerhaave ſaw, after injecting water into the ſtomach and inteſtines of the dog, were owing entirely to tranſudation. In the injection of the veins from the veſiculæ ſeminales, by Profeſſor Mekel, there muſt have been rupture of the coats of the veins in ſome place or other; for though I have fifty times, at leaſt, injected the veſiculæ ſeminales with quickſilver, a more penetrating fluid than melted wax, I never once met with the ſame appearance: beſides, if injections find their way from cavities into the ſuppoſed mouths of veins, they ſhould alſo have found their way into the orifices of the lymphatics, which here were not injected. But injections thrown into the inteſtines, in the dead body, never, that I could obſerve, get into the lacteals, though we know their orifices to be really there. As to the injection of the veins from the cavity of the bladder, by the ſame anatomiſt, I can account for that appearance in another way, and perfectly ſatisfactorily. The lacunæ of the urethra, or the excretory ducts of glands opening on that ſurface, are continued a little way into the cavity of the bladder itſelf, where they are ſtill more delicate in their texture, and eaſily rupture, when inflated with air, or injected with quickſilver. I have injected the veins of the bladder repeatedly from theſe lacunæ; and a paper from Mr. Watſon is publiſhed by the Royal Society, on theſe very lacunæ, where the author ſuppoſes them to be the orifices of lymphatics; and ſays, that he introduced briſtles into them:—when they are ruptured, the veins, arteries, and abſorbents are tore at the ſame time; but the injection gets into the veins, as the larger veſſels. The appearances obſerved by Haller, in injecting the dead body, are alſo certainly to be referred either to tranſudation, which ſo readily takes place in the dead body, or to the veins communicating with the extremities of the arteries, and the injections paſſing off by the then relaxed exhalents. Lymphatics inflame, when they abſorb poiſons, ſuch as the venereal virus, cancerous matter, or the poiſon of the mad dog. Wounds received, both

by myſelf and others, in diſſecting dead bodies, have given me many opportunities of ſeeing theſe veſſels inflamed, from an irritating matter they had abſorbed from ſuch wound. Now, as I never, on any ſuch occaſion, found the veins inflamed, it is reaſonable to infer they do not abſorb theſe poiſons, or irritating matter; and if they do not abſorb on the inteſtines, nor on the ſurface of the body, nor from wounds, that they abſorb no where elſe. As patients are frequently infected with the venereal virus, without its having previouſly inflamed any lymphatic gland, this circumſtance may be conſidered by ſome as a proof of venous abſorption; but it is not: all that it proves is, that the poiſon ſometimes is not able to inflame the glands, or that they are ſometimes leſs irritable, and not eaſily inflamed. That veins abſorb in the placenta, becauſe lymphatics have not yet been found there, is no good argument. Lymphatics have been found in parts formerly ſuſpected to have none; and in whole claſſes of animals, where it was ſaid they did not exiſt: and the analogy is on the ſide of their being there; for if the Author of Nature found the lymphatics neceſſary in all other parts, and if we are daily diſcovering more, then it is moſt probable that they exiſt in the placenta too, though they have not yet been found.

When I ſaid that there might be lymphatics in the placenta, it was the child's portion that I alluded to. I know there are lymphatics in the mother's part; but there the veins alſo ariſe by open mouths, out of cells, and the blood contained in theſe cells enters theſe mouths, and mingles with the circulating blood. This, according to ſome, is clearly venous abſorption: the ſtructure of the corpora cavernoſa, penis, and clitoris, ſeems a good deal to reſemble that of the mother's part of the placenta; and the veins appear to ariſe from cells there too. That the blood gets into theſe veins, from thoſe cells, I do not doubt; but I uſed to explain this as circulation of the blood, not abſorption, in the way Harvey conceived it to be, in the other parts of the body, nearly; that is, he conceived the blood to be thrown from the arteries into a parenchyma, or ſpungy texture, interpoſed between the ends of arteries and beginning of veins; and that the vis a tergo, in the arterial blood, propelled it not only through the ſpunge, but into the veins. Dr. Fordyce ſays, there muſt be ſomething elſe in the ſtructure of theſe parts, not yet underſtood; and rejects not only the

ſolution I have given, of the paſſage of blood into veins, but denies the poſſibility of venous abſorption any where, on the principles of hydroſtatics, independant of the other arguments I have given. Suppoſing, ſays he, an opening made in a vein, there is a preſſure equal to the force of the circulation in the veins, to force the blood out at this opening; it would therefore flow out, and remain out, unleſs there was a force ſuperior to this preſſure to throw it in again: but we know of no ſuch force exiſting in the veins of the common ſtructure. Nor is it poſſible that the vis a tergo, alledged by Harvey, can produce the ſuppoſed effects; for the cells of the ſuppoſed parenchyma, of the placenta, and corpora cavernoſa, mentioned, are not tenſe at the time of the venous abſorption, as it has been called. We know of no force in cavities capable of overcoming the preſſure of the venous blood on the ſides of the veſſels, and of propelling fluids into their ſuppoſed open extremities; though we can eaſily conceive the muſcular force of the lymphatics overcoming this preſſure, in the angles between the jugulars and ſubclavians, for reaſons which will be mentioned afterwards.

But the ſupporters of venous abſorption will perhaps ſtill contend that I have concluded too haſtily, reſpecting the impoſſibility of its exiſtence; and that there are, after all, arguments in its favour, which are unanſwerable. From the hiſtory of the human body, it will appear, ſay they, that more fluids have been abſorbed in a given time, from the cavity of the inteſtines, than the lacteals could be ſuppoſed capable of taking up, or the thoracic duct, conſiſtent with its diameter, or any probable velocity of the abſorbed fluids, could poſſibly tranſmit. The diameter of the thoracic duct, in the middle of the back, ſays Haller, is not more than a line, or the tenth part of an inch; and it tranſmits not only the chyle, but all the lymph of the lower extremities, of the contents of the pelvis, and of the cavity and parietes of the abdomen. Now Boerhaave mentions a man who drank ſixteen pints of wine daily; Haller gives examples of patients drinking 200 ounces of mineral waters in a few hours: but almoſt the whole of theſe fluids were ſoon after returned by urine, which they could not have been, unleſs they had got into the blood by ſome other way than by the lacteals and the thoracic duct: but we know, from experiment, that the quantity of fluid fixed on will eaſily paſs through a tube of a tenth part of an inch in diameter, in

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any of the periods aſſigned, though no other force be applied than that commonly exerted in throwing water through a ſyringe. As to the velocity of the abſorbed fluids, there are very ſtrong reaſons for believing it to be different at different times. No man can tell why the abſorbents ſhould have their orifices immerſed in the fluid of aſcites for months or years, without taking up any ſenſible part of it; and why, on ſome ſtimulus from the conſtitution, they ſhould remove it in three days: this, however, has ſometimes happened; it happened to one of Dr. Hunter's medical friends, as he informed us at lectures; and it has happened to others. The chyle in the lacteals of the meſentery of dogs, in ſome of my experiments, evidently run through a ſpace of four inches in a ſecond, which is 20 feet in a minute: I have at other times ſeen the abſorbed fluids vaniſh with almoſt incredible velocity: ſo that little can be concluded on, againſt the poſſibility of the fluids mentioned being abſorbed by the lacteals, or tranſmitted by the thoracic duct, within the aſſigned periods. The diameter of the thoracic duct, in the middle of the back, where it is narroweſt, is very often double that which Haller has fixed on. Sometimes there are two thoracic ducts, with ſeparate inſertions into the veins. There is conſtantly a trunk in the anterior mediaſtinum, under the ſternum, as large as the thoracic duct itſelf, which is ſometimes inſerted into the termination of the thoracic duct, ſometimes into the trunk of the abſorbents of the right ſide, and which I have ſeen tranſmitting the chyle.—Ruyſch has ſupplied the ſupporters of abſorption by red veins with another argument. He aſſerts, that the lymphatic glands, on the meſenteries of old people, are almoſt entirely obliterated; and, as he believed that all the lacteals went to thoſe glands, if they diſappeared, the lacteals muſt alſo be obliterated or obſtructed: but, as old people frequently enjoy, under ſuch circumſtances, very good health, he could not help believing, that in them the red veins of the inteſtines performed the office of the lacteals. His words are: "Nam in ſpatio meſeræi, palmam manus æquantes duas (glandulas) tantum reperiebam, aut tres ſemine cannabino vix majores. Atque hoc ipſum phænomenon occurrit mihi ſæpius in meſenteriis valde annoſarum anicularum —— Contra vero aperienti cadavera eorum qui in flore ætatis occubuerant, apparuit meſenterium refertum tanta glandularum copia, ut in portione ejus palmæ manus æquali ſexaginta vel ſeptuaginta

ſeptuaginta glandulas invenerim." — From theſe circumſtances he is diſpoſed to draw the following inference: "Sed quid tum chylo contigit qui ſolebat prius per venas lacteas deferri ad has in meſenterio glandulas, certos et neceſſarios in uſus? Ibitne forſitan ille jam per venulas meſentericas exiguas et inteſtinorum cavis abſorptus in ipſum hepar?" Haller ſays, "Dudum ſe abſque lacteis vivere Ruyſchius ſolebat dicere."

To this argument I reply, that all the ſolids ſhrink in old people; ſome, however, in a greater proportion than others, as we ſee in the breaſts of women. It cannot be denied, the glands of the meſentery are exceedingly ſmall in old people; but it does not neceſſarily follow, that they are entirely obſtructed. I have ſometimes ſeen the lacteals full of chyle in old people. Haller ſays, that he has frequently ſeen the thoracic duct full of chyle, in thoſe who had paſſed the 70th year of their age: "In ſenibus," ſays he, "non raro, ductum thoracicum chylo albo plenum reperiiſſem." This could not have happened, if the lacteals had been totally obſtructed; as the meſenteric veins do not lead to that duct, nor has it any other ſpecies of veſſel coming to it from the meſentery. —In the laſt place, it has been ſaid, that animals have not died ſo quickly as they ſhould have done, when the thoracic duct was either tied, tore through, or obſtructed, ſuppoſing it to be the only road by which the chyle could get into the blood. From an experiment of Duverney's, related in the Memoires of the Academy of Sciences, it appears that a dog lived 15 days after the veins, into which the thoracic duct is inſerted, were tied up. Bartholin mentions a caſe where the thoracic duct was wounded, where, notwithſtanding, the patient lived a conſiderable time. His words are, "longa fuit tabes." Mr. Cheſton, of Glouceſter, ſome years ago, ſhewed us in London the thoracic duct from the human ſubject, totally obſtructed with a ſolid ſubſtance, which had every appearance of having remained there for a long time.——Allowing thoſe arguments their full force, they by no means prove that the lymphatics or lacteals did not carry nutritious matter into the blood-veſſels. The thoracic duct is frequently double; and has one inſertion into the right ſubclavian vein, and another into the left. The older anatomiſts were not aware of this, and in their experiments tied up only the left ſubclavian and jugular veins. Beſides, the trunk already mentioned,

tioned, in the anterior mediaſtinum, under the ſternum, though often inſerted into the termination of the thoracic duct, is ſometimes alſo inſerted into the trunk of the right ſide; in which, as I have already ſaid, I have ſeen the chyle. The ſame arguments may be employed againſt the objection of the obſtructed thoracic duct; and, in whatever point of view we conſider this ſubject, there is not one ſolid argument in favour of abſorption by red veins.

CHAP. VI.

A more particular Hiſtory of the Lacteals and Lymphatics.

EUSTACHIUS, a Roman anatomiſt, was properly the firſt diſcoverer in this part of anatomy. It appears, that about the year 1563 he ſaw the thoracic duct, or what is now known to be the trunk of the abſorbent ſyſtem, in a horſe. He has particularly deſcribed it in his Treatiſe de Vena ſine Pari, where he calls it Vena Alba Thoracis. Of the left ſubclavian vein, he ſays, "Ab hoc ipſo inſigni trunco ſiniſtro jugali qua poſterior ſedes radicis venæ internæ jugularis ſpectat *magna quædam propago germinat*, quæ preterquam quod in ejus origine oſtiolum ſemicirculare habet, eſt etiam alba & aquæi humoris plena; nec longe ab ortu in duas partes ſcinditus, paulo poſt rurſus coeuntes in unam, quæ nullos ramos diffundens, juxta ſiniſtrum vertebrarum latus, penetrato ſepto tranſverſo, deorſum ad medium uſque lumborum fertur; quo loco latior effecta, magnamque arteriam circumplexa, obſcuriſſimum finem mihi adhuc non bene perceptum obtinet."

From this quotation, it is impoſſible to doubt his having ſeen the thoracic duct; but, not underſtanding it, he begins at its termination in the left ſubclavian vein, and traces it downwards to its origin, where it is no wonder he was bewildered, ſince the art of injection was not then found

found out; and, as we ſhall afterwards ſee, hardly any of the ſucceeding anatomiſts have been clear on that part.

The anatomiſts ſeem to have paid very little attention to this diſcovery of Euſtachius. He is ſaid, by ſome, to have aſcribed to this vein the function of nouriſhing the thorax; but he himſelf expreſsly diſavows any ſuch idea, and ſays, "*quamvis minime ſit ad thoracem alendam.*" It is not to be wondered, that they made but little enquiry about what he himſelf confeſſes he did not underſtand.

No more, therefore, of this ſyſtem was heard of till the year 1622, when Aſellius, an Italian anatomiſt, inveſtigating the motion of the diaphragm in a living dog, in the preſence of ſome medical friends, accidentally diſcovered white fibres on the meſentery. He took them at firſt for nerves; but obſerving, that after puncture they diſcharged a white fluid, and quickly became collapſed and inviſible, he pronounced them to be new veſſels. Repeated experiments confirmed him in this idea. He went farther; he was not only the firſt who ſaw theſe veſſels, knowing them to be different from arteries and veins, but he alſo, with much ſagacity and penetration, announced their peculiar office. He obſerved, that they were often inviſible on the meſentery, whilſt the arteries and veins were at all times perfectly evident: that whenever the inteſtines contained chyle, theſe veſſels were always full of a ſimilar white fluid. For theſe reaſons, he called them Vaſa Lactea, and aſſigned them the office of abſorbing chyle from the inteſtinal tube, and carrying it into the blood. Before his time, the veſſels of the human body, and of quadrupeds, were ſaid to be of three kinds, arteries, veins, and nerves. Having diſcovered the lacteals, he naturally terms them the fourth kind.

"Vaſa meſeraica (ſays he) Galenus & omnes poſteum anatomici par iter & medici genere triplicia faciunt venas, arterias, & nervos."

"But (continues he) aliud eſt genus quartum novum ac ignotum hactenus, & a me primo obſervatum."

Theſe veſſels he diſcovered not only in dogs, but in a variety of other quadrupeds. He tells us, "Confirmatus gemino hoc experimento, & nihil amplius de re ipſa ambigens, totum me dedi ad perquirendam eam percipiendamque accuratius, in quam curam ita incubui nulla ut temere hepdomada, certe nullus menſis abierit ſine viva

viva una aut altera ſectione. Nec vero in canibus tantum, in brutis plurimis aliis factum periculum, in felibus, in agnis qua lactentibus adhuc qua herbam jam paſcentibus. In vaccis præterea & porcis aliiſque veritas exquiſita. Quin equus etiam huic uni rei emptus & vivus exenteratus."

It does not appear, that Aſellius had ever ſeen the human lacteals: the diſſection of dead human bodies was not at that time practiſed. Haller ſays, in his Bibliotheca Anatomica, that about the year 1600 the Republic of Padua, before that period famous for anatomiſts, omitted even the public diſſections, from parſimony. The Germans were then engaged in war; and the Engliſh had hardly begun to diſſect human bodies. Hence, ſays he, aroſe a fondneſs for comparative anatomy; " ut per quadraginta annos in anatome comparata uſque vivorum etiam potiſſimum animalium medicorum ſcalpelli occupati fuerint." In this ſituation of anatomy, Aſellius, of courſe, could have no opportunity of ſeeing the human lacteals. His enthuſiaſm would have led him to have opened living men, as he had living dogs; but he gravely informs us, that he checked that inclination: " Hominem vivum quod tamen Eraſiſtratus olim & Herophilus non timuere, non incidi fateor; nec incidam, qui nefas & piandum morte cum Celſo exiſtimo præſidem ſalutis humanæ artem peſtem alicui eamque atrociſſimam inferre."

Though Aſellius had not ſeen the lacteals in men, he inferred their exiſtence from analogy, and firmly aſſerted it. But this doctrine was far from being generally received; and the doctrine of Hippocrates and Galen, which taught that the chyle was abſorbed from the inteſtines by the red veins, more generally prevailed; and Aſellius's veſſels were conſidered by the greater number of anatomiſts as fictitious. Nor was this to be wondered at: they were not only influenced from reſpect to the ancients, but Harvey, the great diſcoverer of the circulation of the blood, then in his career of glory, oppoſed the doctrine, and never believed in the exiſtence of Aſellius's lacteals.

" Apertum itaque eſt, chylum, quo cuncta animalia nutriuntur, ex inteſtinis per venas meſeraicas deferri, nec opus eſſe ut novum iter venas lacteas ſcilicet inquiramus, aliumve tranſitum in

adultis comminiſcamur, præter eum quem in ovo & pullo compertum habemus."

In another place he ſays, "In plurimis animalibus chyliferi hi canales non omnino reperiuntur."

"Neque in ullis omni tempore occurrunt, cum tamen vaſa nutritione deſtinata debeant neceſſaria omnibus animantibus, omnique tempore adeſſe."

For ſeveral years, little was added to Aſellius's diſcovery: but in 1634, Veſlingius, according to Haller, firſt ſaw the lacteals in men, and gave a figure of them. This figure is not very correct; but neither are the figures of the ſkeleton itſelf, given by the earlier anatomiſts, more correct: nor have we a right to expect, that a perſon who ſees any thing for the firſt time, can conceive it, or draw it, as well as more opportunities would have enabled him to do, or as one who comes after him, with the advantage of his knowledge, may be able to do. It appears alſo, from paſſages alluded to by Haller in Veſlingius's poſthumous works, that he was the firſt who ſaw the lymphatics of the liver, though he took them for lacteals. As Bartholin, to whoſe care theſe works were entruſted, muſt have read theſe paſſages, Haller thinks it extremely probable, that it was there he received his firſt information of the lymphatics. "Cum præterea ad Bartholinum poſthuma ſcripta clari viri pervenerint, & hi ipſi loci a Bartholino editi ſunt, ſumme probabile fit hunc ſcriptorem veſtigia Veſlingii ſecutum, oſtenſam ſagaci viro prædam majori felicitate adtigiſſe."

As a farther proof of his abilities, Haller mentions him as the firſt diſcoverer of the thoracic duct, after Euſtachius. "Idem Veſlingius, niſi plurimum fallor, primus poſt Euſtachium, contra omnes coætaneos, rectius, anno 1649, vidit vas lacteum grande in pectus adſcendere; cum reliqui inciſores, partim ab Aſellio perſuaſi, et partim a lymphaticis vaſis hepatis ſeducti, chyliferos ductus ad hepar ducerent."

In a ſtill later work, his Bibliotheca Anatomica, Haller, ſpeaking of Veſlingius's poſthumous work, terms it "aureum undique opuſculum cujus non licet hic divitias omnes decerpere;" and then adds, "de lacteis vaſis etiam in homine viſis plurima experimenta habet, & anno 1647 duplicem ductum chyliferum vidit."

Whatever Veſlingius might have known, it has been latterly underſtood that Rudbeck, a Swede, twenty-eight years after Aſellius's diſcovery of the lacteals, without any previous information on this ſubject, alſo diſcovered the lymphatics in quadrupeds. He ſuppoſed them a fifth ſet of veſſels; and as they neither carried red blood, like arteries and veins, nor chyle, like the lacteals, but a tranſparent fluid, like ſerum, he calls them Vaſa Seroſa.

About the ſame time, Bartholin, the Dane, alſo ſaw theſe veſſels; but, independent of the hints he received from Veſlingius, there are ſuſpicions that he muſt have previouſly heard of Rudbeck's diſcovery; for, in his publication on this ſubject, he ſays, "Sibi vaſorum ſeroſorum nomen non placere quod aliqui his vaſis impoſuerint." — Bartholin changed the name into Vaſa Lymphatica, a name they have ſince retained; for, as he firſt publiſhed an account of them, and as he was a man of more eminence than Rudbeck, the whole medical world gave him the credit of the diſcovery. He himſelf, however, ſeems to be content to ſhare this diſcovery with Rudbeck and Jolyffe: "Similes aquoſos," ſays he, "ductus detexit & poſtea deſcripſit Olaus Rudbeck: in Anglia de Jolivio quoque ſuo gloriantur amici; quin nobis, cum aliis hinc inde viſa ſunt negare nolim; ſed nobis qui primi in arenam deſçendimus nullus mortalium viam demonſtravit."

Bartholin having mentioned Dr. Jolyffe, it may be proper alſo to ſtate his right to the diſcovery of the lymphatics. Gliſſon ſays, that in the beginning of June 1653, Dr. Jolyffe, who was then taking his degree at Cambridge, informed him, "Dari vaſorum quartum genus a venis, arteriis, nerviſque plane diverſum, idemque ad omnes aut plurimas ſaltem corporis partes diſtribui, & humorem aquoſum in ſe complecti. Addebat porro ſe in compluribus animalibus eorumdem ductum inveſtigaſſe in artubus, ſcil. teſticulis, utero, aliiſque etiam partibus: certoque ſibi conſtare liquorem in iis intro verſus meſenterium tendere, & particulatim ad initium ſive radicationem ejus."

As to Gliſſon's evidence, I muſt obſerve, that Dr. Jolyffe conſidered the nerves as veſſels, and therefore uſes the words "quartum genus vaſorum." At the ſame time, he appears to me to have forgot Aſellius's diſcovery of the lacteals, or he would have ſaid "quintum genus," unleſs he imagined his veſſels and Aſellius's the ſame; and then

Gliſſon would never have ſeriouſly informed us, that Jolyffe had diſcovered a new ſet of veſſels, Aſellius having informed us of them long before. Three years alſo intervened between this diſcovery of Jolyffe's and that of Rudbeck's.

Charleton alſo ſays, "Norunt autem e doctiſſimis noſtri Med. Lond. Collegii tum ſociis tum candidatis complures novum iſthoc vaſorum genus per annos, aliquot antequam Bartholinus de eo quicquam ſcripto publico divulgarat a Jolivio noſtrate, quo accuratius feliciuſve nemo uſus eſt unquam cultello anatomico, & cui ſi fata longiorem vitam indulſiſſent————ſæpius et obſervatum fuiſſe."

And Boyle atteſts the ſame thing:—"By an accident too, as himſelf hath told me, did our induſtrious anatomiſt, Dr. Jolyffe, firſt light upon theſe yet freſhly detected veſſels; which afterwards the ingenious Bartholinus, without being informed of them, or ſeeking for them, hath met with, and acquainted the world with under the name of Vaſa Lymphatica."

Though, in compliance with anatomiſts in general, I have conſidered the Abſorbent Syſtem as conſiſting of two parts, and have given the hiſtory of the diſcovery of each part; yet, in fact, lacteals and lymphatics are branches of one common trunk; and therefore Veſlingius, Rudbeck, Bartholin, and Jolyffe, may be rather ſaid to have ſeen the veſſels firſt ſeen by Aſellius, in other parts of the body than the inteſtines, meſentery, and liver. They did not properly diſcover a new ſet of veſſels, but ſome more branches of the ſame ſyſtem. On the other hand, Aſellius had an idea that his veſſels were formed only for the purpoſe of carrying the chyle into the blood; he had no conception of their exiſting any where elſe; ſo that, without the diſcovery of the lymphatics, we muſt have remained ignorant of the greateſt part of the abſorbent ſyſtem; and therefore they are equally entitled to the honour beſtowed on diſcoverers of ſo important a part of our machine.

The three firſt of theſe anatomiſts not only found Aſellius's veſſels in a great many other parts, but they corrected his error in making the lacteals go to the liver; and they found out the trunk of the ſyſtem. They alſo demonſtrated all this in the human ſubject. It does not appear, however, that they underſtood the lymphatics to be exactly the ſame veſſels as the lacteals. Rudbeck thought that they abſorbed, as Aſellius

had asserted and proved of the lacteals; at least he comes very near the doctrine; but proposes it rather as something he suspected, than a thing he was certain of. "Ita hæc quoque vasa, ad aliqua munera obeunda extructa fuisse arbitror—intus excavata & fistulosa sunt, infinitas habentia valvulas, ne humor e glandulis vel aliis partibus exsuctus iterum refluat."

Bartholin, whose doctrine was better known, and more commonly received, though he was perfectly satisfied as to the origin and functions of the lacteals, had doubts respecting the origin and functions of the lymphatics; for he says, "Exortus lymphaticorum vasorum est ab externis partibus, seu, artubus, et visceribus, hepate nempe vesicula fellis, &c."

"Qua parte ex artubus prodeant, an a venarum extremis, vel musculis, nec dum oculis assequi potuit ob vasorum subtilitatem. Conjecturæ si quis locus, a partibus nutritis debent emergere ob usum postea asserendum, quanquam nec a venis capillaribus impossibilis sit exortus."

"Qui in nervis circulationem admittunt nullam commodiorem hæc viam invenient."

The absorbents have since been found in other classes of animals; but had they never been found in any other, it could not have, with any propriety, affected our reasonings on men and quadrupeds, where we knew that they actually existed, and where their function appears to be as certain as their existence. All that we have gained by the discovery of these vessels, in amphibious animals, birds, and fishes, is the proof of the simplicity and uniformity of nature, in doing the same thing, in all the different classes of animals, in the same way.

Mr. Hunter first discovered them in the crocodile, and in the goose.

Mr. Hewson first discovered them in turtle, and believed he first saw them also in fish.

Thomas Bartholin, however, claims a prior right to the last, if we are to give him credit, having seen those vessels in the globe fish: "Fide mea apud te, mi Horsti, exciderim nisi in omnibus animalibus reperiantur maximis minimisque; in ipsis quoque piscibus, quod orbis exemplo quidem demonstravi."

Haller

Haller alſo mentions this; and, ſpeaking of Bartholin, ſays, " Ex orbe piſce lactea ad hepar euntia deſcripſit."

Haller, at one time, entertained doubts of the exiſtence of theſe veſſels in other parts of the body than where they had been ſeen; and thought them, to the laſt, too inconſiderable to perform alone ſo important an office as abſorption.

" Reſpondebimus interim," ſays he, " reſorbtionem peragi ubi nunquam certa fide ejuſmodi vaſa oſtenſa ſunt ut in cerebro, pleura, peritonæo & cute."

Again :—" Sed neque ocularum lymphatica vaſa in nuperis experimentis aut mei aut Zinnii clariſſimi adpoſuerunt—medullæ ſpinalis aquoſa vaſa—nondum ſatis iteratis periculis confirmata habemus."

" In capite, et artubus pauca."

" In vola manus, dorſo pedis, dorſo trunci, natibus nulla omnino deſcripta."

And, laſtly,—" Deinde fateri oportet, poſt tot induſtriorum virorum labores fragmenta tamen eſſe, ea omnia quæ de vaſis lymphaticis ſcimus, neque ullo modo cum arteriorum & venarum, aut nervorum hiſtoria deſcriptiones vaſorum aquoſorum comparari poſſe."

Later writers than Haller have alſo treated the lymphatics and lacteals, or real abſorbents, as a trifling appendage of the red veins.

CHAP.

CHAP. VII.

Lacteals ſeen by the Ancients, but not underſtood.

I Muſt obſerve, however, that there are ſome veſtiges amongſt the ancients, that prove they had alſo ſeen lacteals. In the firſt place, there are paſſages in Hippocrates, or in the books aſcribed to him, from whence it is ſuſpected that he knew ſomething of the lacteals; for, after he has deſcribed the larger veins in the body, he ſays, " Εισὶ δὲ καὶ ἀπὸ της κοιλης φλεβες ἀνὰ τὸ σῶμα πάμπολλαι τε καὶ παντοῖαι, δι' ὧν ἡ τροφὴ εν τῶ σωματι ερχεται."

" There are alſo in the body, veins from the ſtomach, very many, and of all kinds, by whoſe means the food comes into the body."

Here I muſt obſerve, that Hippocrates, or whoever he was who wrote this ſentence, could not mean the real abſorbents: no veſſels different from arteries and veins are eaſily to be ſeen there. The lymphatics of the ſtomach are found with very great difficulty, as they never, like the lacteals, carry an opaque fluid.

Galen contending, that the arteries contain ſomething elſe than air, ſays, that it was the doctrine of Eraſiſtratus, that they contained both air and blood, but that they firſt emptied themſelves of the air before they took in the blood. Tending to the ſame purpoſe, he mentions the following experiment, as from the works of Eraſiſtratus: " Εν γαρ τῶ διαιρεῖσθαι το ἐπιγάςριον, ἅμα τῶ περιτοναίῳ, κατα τὸ μεσεντέριον αρτηρίας ἰδεῖν ἐςι, σαφῶς, ἐπὶ μεν των νεωθηλων ἐρίφων γαλακτος πληρεις."

" For on dividing the epigaſtrium, and along with it the peritonæum, we may clearly ſee arteries, on the meſentery of ſucking kids, full of milk."

Aſellius ſeemed to be perfectly aware of this; for he ſays, in his book on the Lacteals, " Denique nec minus verum illud eſt, quod addidi, viſa quibuſdam eorum fuiſſe, nec tamen cognita. Eraſiſtratum enim,

enim, et ejus aſſeclas intelligo, quem vidiſſe noſtras venas, & ſuis oſtendiſſe, ex duobus Galeni locis manifeſtum mihi eſt. Ex utroque enim liquet ad probandum ſolum ſpiritum in arteriis attineri, confluere autem poſt ſanguinem, vel aliam naturam quamcunque, experimento hoc anatomico uſum eſſe, quod in hædis nuper lactatis, ſi venter imus & interior membrana dividantur, initio ſimul ſcilicet, ac nudatum meſenterium fuerit, arteriæ *διερροιδῆς*, id eſt, aere, mox plenæ lacte conſpiciantur. Vidit igitur omnino lactea hæc vaſa, nec agnovit tamen, quippe, quæ pro arteriis, deceptus veri quadam inani ſimilitudine, habuerit. Ex quibus omnibus ſatis, opinor, patet, ignorata fuiſſe hactenus vaſa, quæ primi inveniſſe profitemur."

Galen alſo ſays, that Herophilus taught, there were veins ariſing out of the inteſtines, which did not go to the liver, but to certain glands on the meſentery, and which were the nutrient veins of theſe glands. "Πρῶτον μεν γάρ παντι τω μεσεντερίῳ φλὲβας εποιησεν ἰδίας ανακειμενας αὐτῷ τη θρεψει των ἐντέρων μη περαιουμὲνας εἰς το ἧπαρ. ὡς γαρ καὶ Ηροφιλος ἔλεγειν, εις ἀδενώδη τινὰ σῶματα τελευτῶσιν ἅυτας ἀι φλὲβες, των ἄλλων ἁπασῶν επι τας πυλας ἀναφερομὲνων."

"For, in the firſt place (Nature) has made, in the whole of the meſentery, peculiar veins, deſtined for the nouriſhment of the inteſtines, not paſſing to the liver: for, as Herophilus ſays, theſe veins terminate in certain glandular bodies, whilſt all the reſt are carried upwards to the portæ (or liver)."

From the paſſages I have quoted, it is evident that the ancients underſtood ſomething of the doctrine of abſorption: it is alſo, I think, not to be denied, that they had ſeen parts of the real abſorbent ſyſtem, though they did not underſtand them.

CHAP.

CHAP. VIII.

Further Confirmation of the Abſorption of Fluids by the Lymphatic Veſſels.

THAT the lacteals abſorb from the inteſtines, has been ſo fully proved, that there is not now an anatomiſt living, who has the ſmalleſt doubt concerning the fact. They have not only been ſeen abſorbing the chyle, but they take up, very readily, coloured fluids thrown into the inteſtines. Every experiment Mr. Hunter made on the inteſtines of living animals, at the ſame time that it refuted abſorption by red veins, in the ſtrongeſt manner confirmed abſorption by the lacteals. They quickly abſorbed the milk, the ſolution of ſtarch in water, coloured with indigo, the muſk-water; in ſhort, every fluid which was thrown into the cavity of the inteſtines. I have already mentioned the arguments which induced Dr. Hunter to advance the doctrine, that lacteals and lymphatics were the ſame ſpecies of veſſels, and that both abſorbed. I come now to offer ſome additional proofs of this. An accuſtomed eye finds very little difficulty in diſtinguiſhing lymphatics from every other ſpecies of veſſel, in men or quadrupeds; their valves, their general appearance, their intercourſe with conglobate glands, ſufficiently mark them. Now the lymphatics are not only branches of the ſame trunk, as Dr. Hunter obſerved, but there is ſuch a connection between them, ſuch an anaſtomoſis, that the fluids abſorbed by the lacteals are in part tranſmitted to the lymphatics, and through them, at laſt, conveyed into the blood. A very remarkable inſtance of this kind I demonſtrated at lecture in Windmill Street, about two years ago. The lymphatics of the diaphragm were ſeen turgid with chyle, which they had received from the lacteals, ſome of which were paſſing that way, towards the ſubclavian veins. A ſtronger proof that lymphatics are abſorbents, is, that whenever fluids are extravaſated on ſurfaces, or into cavities, or whenever ſuch fluids preternaturally diſtend their reſervoirs,

the lymphatics belonging to theſe ſurfaces and cavities are found full of the ſame fluid. This is better demonſtrated, when the fluids mentioned happen to be of a ſtrong colour. Thus I have repeatedly ſeen, in animals dying of hæmoptoe, and in the human ſubject itſelf, the lymphatics of the lungs, which at other times contain a tranſparent fluid, turgid with blood, which they had abſorbed from the air-cells. Where gall-ſtones, in the ductus communis coledochus, or in the cyſtic duct, have prevented the bile from flowing into the inteſtines, and the gall-bladder, in conſequence of this, became preternaturally diſtended with that fluid, I have alſo ſeen the lymphatics of that reſervoir full of the bile they had abſorbed from its cavity. Baron Haller aſſerts, that he had repeatedly ſeen the lymphatics, as well as the lacteals, full of the coloured fluid he had thrown into the living body. "In animale, cui plena fuerunt aut chylo, aut lympha, aut cæruleo liquore, quem animalia, abſorbere coegi, ſub ipſis intentis meis oculis, toties vidi hæc, ſive lymphatica vaſcula, ſive lactea evaneſcere." Malpighi ſuſpected that the lymphatics perſiſted in abſorbing, even for ſome time after death; and I found this to be true in quadrupeds: on making ligatures on the trunks of the principal blood veſſels, no lymphatics were then viſible; but in an hour after I found them turgid with lymph. Maſcagni, Profeſſor of Anatomy at Sienna, in his Prodrome to his Hiſtory of the Lymphatics, aſſerts, that fluids thrown into cavities, get into the abſorbents many hours, or even days, after the body is dead. After what I have ſaid of tranſudation in dead bodies, it may be doubted whether this penetration of fluid was abſorption, or tranſudation only. "J'ai injecté," ſays he, "par un petit trou, de l'eau chaude colorée différemment dans les cavités du thorax & du bas-ventre de pluſieurs cadavres, & j'ai obſervé que cette eau coloreé a pénétré dans les vaiſſeaux lymphatiques de ces cavités, & dans les vaiſſeaux lymphatiques ſuperficiels des viſceres qui ſont placés dans les mêmes: quelquefois je n'ai pas reconnu que la liqueur de la cavité ait pénétré dans les vaiſſeaux lymphatiques.

"J'ai fait le plus ſouvent uſage de l'encre pour donner la couleur à l'eau chaude. J'ai fait uſage des cadavres d'enfans & de jeunes gens, ayant obſervé que dans ceux des vieillards ils ne ſe rempliſſent pas ſi facilement. J'ai fait les ſuſdites injections depuis ſix heures

juſqu'à

jusqu'à 48 après la mort, & j'ai observé que, dans les adultes, après les 6 heures ou 8 de la mort, ils ne se rempliſſent pas ſi facilement, mais que, dans les enfans, quelquefois ils ſe rempliſſent auſſi après 40 heures."

Theſe experiments did not ſucceed with me.

CHAP. IX.

Methods of diſcovering the Lymphatics and Lacteals.

THE arteries and veins are eaſily found, and pretty generally known. Their trunks ariſe from, or terminate in, the heart; and, as this may eaſily be found in moſt animals, hence it is not difficult to find the arteries and veins: but the trunk of the abſorbents not terminating immediately in the heart, but in the veins, at ſome diſtance from it, and this trunk, when it is found, being crowded with valves, which makes the injecting from trunk to branches, as in the arterial ſyſtem, impoſſible, the abſorbents are with difficulty detected, and in proportion leſs known. It is for this reaſon I have choſen to give the different methods of finding them.

The lacteals were diſcovered in conſequence of the animal's being opened alive, ſome hours after it had been fed: theſe veſſels were then ſeen turgid with the chyle they had abſorbed from the inteſtines. At all other times, they are either empty, or contain a ſmall proportion of colourleſs or tranſparent fluid. The anatomiſts ſtill continue to employ this method with ſucceſs. From the experiments formerly mentioned, as made on living animals, it appears, that theſe veſſels may be made viſible at any time, by throwing coloured thin fluids into the inteſtines, as theſe are almoſt immediately abſorbed, and appear in the

lacteals. Ligatures made on the trunk of the ſuperior meſenteric artery muſt neceſſarily include the trunk of the abſorbents: ſuch ligatures, therefore, in the living animal, preventing the abſorbed chyle from paſſing into the thoracic duct, and of courſe detaining it in the lacteals, are very uſeful in demonſtrating theſe veſſels. An eye accuſtomed, readily diſtinguiſhes lacteals on the inteſtines from arteries and veins, even when they are collapſed and empty: punctures may be made with a lancet, and the veſſels injected with quickſilver by means of a tube formed expreſsly for that purpoſe. I have ſometimes injected the lacteals, in conſequence of punctures made by the ſides of the veins, where I knew they muſt be, though they were then inviſible to the naked eye.

When the glands of the meſentery have been enlarged from ſcrophula, I have obſerved that the lacteals were then larger, and eaſier to be diſcovered or injected: this I conſider as the conſequence of obſtruction in the glands, and of encreaſed action in the veſſels, in order to overcome that obſtruction; though I do not remember an inſtance of ſuch obſtruction in the meſenteric glands, as made the chyle remain in the veſſels.

The lymphatics, in general, are not ſo eaſily diſcovered. On the liver and lungs they are frequently viſible, though collapſed and empty; and may be injected by puncturing one of the ſmall branches, and throwing in mercury in the courſe of the abſorbed fluids; but the valves almoſt always make the injecting from trunk to branches impracticable. Though the trunks of the lymphatics are generally collapſed and empty in the dead body, yet the extreme branches almoſt always contain ſome little reddiſh or browniſh fluid, which, by preſſure in the direction of the courſe of the abſorbed fluids, may be forced from theſe extreme branches into the trunks, and, by this means having become viſible, may be punctured, and injected with quickſilver. I have, in this way, ſucceeded in injecting the lymphatics of the kidney.

Watery fluids thrown into the arteries, veins, or excretory ducts of the glandular viſcera, very commonly get into the lymphatic veſſels, which then becoming viſible, punctures may be made in the ſmall branches, and the watery fluids be forced out or diſplaced by injecting quickſilver.

One

One of the best methods I have found was, previously injecting the arteries and veins of the part where I wished to see the lymphatics, and then throwing it into water, to macerate, for some days; as soon as a certain degree of putrefaction takes place, air is let loose in the cellular membrane, from whence it gets into the orifices of the lymphatics, and uniformly fills their branches: in this way I first discovered them on the heart and in the uterus; punctures may be then made in the smaller branches, and the air may be forced out by an injection of quicksilver.

I must here observe, however, that in employing this method it will sometimes be necessary to inject, previous to the maceration, several sets of veins, and perhaps some other species of vessel also, before it can be fairly inferred that any new vessel filling itself with air was a lymphatic. Were one to set about discovering the lymphatics of the liver in this way, he must inject previously the hepatic artery, then the vena portarum, then the venæ cavæ hepaticæ, and other smaller veins entering the cava, but not properly branches of the former: when he has done this, he must also inject the ductus hepaticus, and its branches the pori biliarii, before he could infer that any new vessel filling itself with air, in consequence of maceration of the viscus in water, was a lymphatic. I must, however, observe, that on the extremities this method cannot be employed, as the valves prevent us from injecting the veins, unless on some lucky occasion, where they are now and then injected from the arteries, as continued but reflected tubes, and in the course of the circulating blood.

The lymphatics are with more difficulty discovered on the fore-arm and leg than in most other parts. Here the choice of the subject is a very material circumstance: there should be no fat in the limb; it should be dropsical, and yet not too much so. The fat hides the lymphatic vessels so as to prevent our seeing them. If there is much water in the cellular membrane, the vessels are very well seen; but they are not sufficiently supported: they roll under the point of the lancet, and escape the attempts to puncture them; or, if the puncture has been effected, they glide away from the point of the injecting tube. I have seen some hundred vessels on an extremity, where, for the reasons I have just given, I have been only able to inject a few. When a proper limb has been procured, I make ligatures

ligatures on the top of the foot, or back of the hand, and, by repeated stroking of the toes or fingers, force the brown fluid in the extreme branches of the lymphatics into larger branches: the ligatures prevent it from being drove on, and the vessels gradually become distended close by the ligature. The integuments are then to be removed, so as to leave the absorbents, which lie immediately underneath, intire. Punctures may be then made in the vessels, and quickfilver may be injected. From a single puncture in a vessel on the top of the foot, I have injected sixteen absorbents running the whole length of the thigh. Mascagni says, that in cases of induration of the lymphatic glands in the axilla or groin, he has found the lymphatics of the arm and leg distended with their own lymph, which not being able to get through the diseased glands, stagnated in the vessels, and made them so distinctly visible, that he drew them as if they had been injected with mercury.

"J'ai dit (says he) qu'il faut choisir les cadavres des hommes morts de consomption, parce que, dans ces cadavres, ordinairement les glandes lymphatiques étant engorgées, & la lymphe ne pouvant pas passer, les lymphatiques sont dilatés, & remplis par la même; conséquemment on les voit plus aisément." It appears also that he sometimes had drawings made of them in this state, without being under the necessity of injecting them.—"Vaisseaux.—Les branches étoient remplies naturellement de lymphe, & pour cela visible au desinateur."

In the upper part of the arms and legs, the business of injecting and discovering the lymphatics is easier. A gland is almost always to be found on the fore-part of the internal condyle of the humerus. This gland may be punctured with a lancet, and the tube, filled with quickfilver, may be introduced by this opening; or, which succeeds equally well, the tube may be pushed into the substance of the gland at once, without any previous puncture by the lancet. The mercury thus fills the cells of the gland, and from these the deeper seated absorbents, which run with the brachial artery. In the lower extremity, the absorbents which run with the femoral artery may be injected in the same manner, from glands situated in the ham. The trunks of the lymphatics, from the heart and lungs, may be injected in this way, from glands about the root of the lungs and fore-part of the trachea. The absorbents of the neck, in this way also are injected, from glands very constantly

found on or behind each mamillary proceſs. The trunk of the ſyſtem itſelf, the thoracic duct, is moſt ſucceſsfully injected in the ſame way, that is, either from ſome gland on the meſentery, on the bodies of the lumbar vertebræ, or on the inſide of Paupart's ligament.

When veſſels are injected, and very much reſemble lymphatics, the beſt method of determining whether they are or are not lymphatics, is to trace them to the neareſt lymphatic glands: if they terminate in them, they are lymphatics.

CHAP. X.

Origin of the Lacteals and Lymphatics.

FROM the ſeveral facts already mentioned, it is evident that the lacteals, taking up whatever is thrown into the cavity of the inteſtines, muſt ariſe from their internal ſurface; that the lymphatics of the lungs, abſorbing blood from the air-cells, muſt have their origin from theſe cells; as well as that thoſe abſorbing bile from the gall-bladder, muſt have orifices opening into that cavity.

That mercury is abſorbed from the ſkin, cannot be doubted; for, when rubbed on the ſkin, it produces a braſſy taſte in the mouth, ſtimulates the ſalivary glands, the inteſtines, and ſometimes all the glands of the body, and produces all other appearances which it does when taken into the ſtomach. The ſame is true of many other medicines. It is therefore evident, that the lymphatics ariſe from the ſkin. Alſo, it may be inferred, as they ariſe from theſe cavities and ſurfaces, that they probably ariſe from all cavities and ſurfaces of the body. In confirmation of this, we ſee fluids morbidly accumulated, abſorbed from all the cavities of the body.

We know that this accumulation is, in the healthy ſtate of the body, conſtantly

conſtantly prevented by the ſame veſſels. This idea appears long ago to have preſented itſelf to the ingenious Willis: "Enimvero, ſæpe ſæpius miratus ſum quid fiat de effluviis vaporoſis, quæ perpetim, è ſanguine in præcordiis efflagrante, copioſiſſime, et nonnunquam impetuoſiſſime dimanant." And then, by and by, ſpeaking of the lungs, he explains this, and ſays, "Quapropter loculi, ſeu ſpatia iſta inania ubique ex omni parte diſponuntur, quæ vapores in pulmone occluſos excipiant, & eoſdem mox condenſatos per lymphæ ductus, quaſi per totidem alembici roſtra, extillent."

The water of the hydrocephalus, depoſited in the ventricles of the brain, we have every reaſon to believe, has been ſometimes abſorbed from theſe cavities; for the ſymptoms of the hydrocephalus, which are exceedingly well marked, have made their appearance, and then, from the uſe of remedies, again diſappeared. The water of the hydrothorax has alſo ſometimes been removed; and we have occaſionally known aſcites cure itſelf. Now, as it has been proved that tranſudation does not take place in the living body, it follows, that if fluids are depoſited in, and then removed from, cavities, it muſt be by abſorption, the only power we know an animal body to be poſſeſſed of, which is adequate to this effect. In œdema of the legs, friction, we know, frequently occaſions a removal of the fluid. Now, as friction becomes a ſtimulus to the arteries and veins, and accelerates the motion of the blood through the parts, we have reaſon to conclude, that the ſame friction becomes a ſtimulus to the lymphatic veſſels, and obliges them to take up the extravaſated fluid. When the bones are diſeaſed, the lymphatic glands in their vicinity become inflamed, and ſuppurate as in the diſeaſes of ſoft parts. This circumſtance proves that the lymphatics ariſe alſo from the bones. To this it may be objected, that the bones are never diſeaſed, without the ſoft parts participating more or leſs in the diſeaſe, and it may be the lymphatics of the ſoft parts, and not of the bones, which are thence affected: but, as I have injected the lymphatics of bones, and know them to be poſſeſſed of theſe veſſels, as well as the ſoft parts, this objection carries but little weight with it; and the concluſion I have drawn, is a much more natural one. Malpighi had an idea, that the lymphatics aroſe only from follicles; but theſe veſſels are found in many parts of the body where there is not the leaſt veſtige of a follicle. They were next ſaid to ariſe from the excretory ducts of glands, and they certainly do ſo,

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but not more particularly from these than from other parts. I have repeatedly injected quickſilver (a fluid which I never found tranſude) into the tubuli lactiferi in the breaſts of women and of quadrupeds, and generally found that I injected the lymphatics at the ſame time; the mercury paſſing into the orifices of the lymphatics, ariſing from the internal ſurfaces of theſe ducts. — Mercury likewiſe, thrown into the ureters, has frequently returned by the lymphatic veſſels, which were ariſing from their internal ſurfaces. The ſame injection, thrown into the ductus hepaticus, has returned by the lymphatics of the liver: "In hepate," ſays Haller, "aer aut argentum vivum per ductum colidochum impulſum, in lymphatica vaſcula venit, ut etiam facilius per eum ductum, quam per portarum venam, ea pellucida vaſcula replentur." The lymphatics are among the vaſa vaſorum of arteries and veins, and certainly ariſe from their external ſurfaces. I am alſo fully perſuaded that they ariſe from their internal cavities. In animals ſtrangled, or dying of ſome violent death, the lymphatics about the ſpleen, and in the cavity of the abdomen in general, are almoſt always found turgid with blood, though I have never ſeen, on theſe occaſions, any marks of extravaſation of that fluid into the cellular membrane. In peritoneal inflammation, I have demonſtrated the lacteals full of blood, though in this inflammation there is little or no ſwelling, of courſe no extravaſation of blood into the cellular membrane. I have ſeen the abſorbents of the lungs alſo loaded with blood, in the peripneumony or inflammation of their ſubſtance; and on all theſe occaſions have been induced to believe that the lymphatics aroſe from the internal ſurface of arteries and veins. This opinion is not without its difficulties; for arteries and veins have been diſtended with injected fluids on many occaſions, without the ſmalleſt drop of theſe fluids paſſing into the lymphatics; and one of the arguments, by which the origin of the lymphatics from ſurfaces is ſupported, is, that they cannot be injected from arteries or veins. On the other hand, there is no anatomiſt, who has been at all converſant in injecting arteries and veins, but on ſome occaſion or another muſt have found, that from theſe he had alſo injected the lymphatics. "Certe novimus," ſays Haller, "nulla arteria fracta, nullo liquore extra vaſa effuſo, tamen per arterias, vaſa lymphatica, ipſumque

ductum thoracicum repletum fuiſſe." I have injected the thoracic duct, and many of its branches, from the umbilical vein, in children. I do not pretend to ſay whether this was from the arteries or veins, for, in this way of injecting, the ductus venoſus and ductus arterioſus being both open, you inject both arteries and veins at the ſame time. On the proceſs of the peritonæum of the porpoiſe, through which the ſpermatic veſſels run, I inflated the abſorbents from the veins with the gentleſt breath I could blow: But here it may be objected, that in this animal there may be ſome uncommon connection between red veins and abſorbent veſſels. I cannot ſay, that there may not be ſuch connection; but I ſtrongly ſuſpect that there is not. Profeſſor Mekel ſays, "Bis, hac etiam præterita hyeme, vaſa lymphatica, et ipſum ductum thoracicum, ex venis replevi."

If lymphatics, it may be ſaid, ariſe from arteries and veins, why do we not oftener inject them from theſe veſſels in the dead body? To this I reply, the veins are certainly continued from the arteries, and yet we count it a lucky injection, if we fill the veins from the arteries, unleſs the fluid injected is a very ſubtile one, and ſuch as does not quickly coagulate; oil of turpentine will often do it, but it tranſudes through the coats of veſſels, and we can never be certain of what really has taken place. Quickſilver often returns by the veins, and, as it never tranſudes, we are more certain of what we have done; but the quickſilver will not always return by the veins. I have injected the arteries of the inteſtines to the utmoſt with quickſilver, and yet not a particle has returned by the veins. I have reverſed this, and injected the veins to the utmoſt, and yet none of the quickſilver returned by the arteries. Are we, therefore, to infer, that the arteries and veins are not connected, after ſo many proofs that they certainly are? Again it may be ſaid, If lymphatics are connected with arteries, like veins, why are they not, like them, full in the dead body? The veins then become full, and contain almoſt all the blood which the arteries and they together contained during life. The reaſon of this is evident: the blood in the arteries is not only propelled by the force of the heart; but the arteries continue to propel their contents, after the heart has ceaſed acting. As the veins are ſo much more capacious than

than the arteries, they eaſily contain the whole; and it muſt ſtagnate there, becauſe, the lungs being collapſed, the blood of the pulmonary artery cannot get through, of courſe, it muſt remain full; and if it remain full, the right ventricle, for a ſimilar reaſon, muſt do ſo too, and ſo muſt the right auricle, and thence the whole venous ſyſtem. Now, if the lymphatics are connected with the arteries, why are they not alſo full in the dead body? In the firſt place, their connection with arteries is different from that of the veins. The veins muſt receive the blood propelled by the arteries, and are in ſome ſenſe paſſive; but abſorbents have their orifices ſometimes immerſed in fluids for years, and take up none of them, till a particular ſtimulus for abſorption is given. This we have ſometimes ſeen in the natural cure of aſcites, when the abſorbents of the abdomen have of their own accord, and without the leaſt aſſiſtance from medicine, in two or three days removed the whole of the contained fluid, though no alteration had taken place for years before. In the next place, the abſorbents are ſtill more irritable than the arteries. They continue to propel their fluids generally for ſome time after death; and, as the veins are fully capable of holding their fluids as well as thoſe of the arteries, the lymphatics are empty in the dead body, and may notwithſtanding be connected with the arteries and the veins too, in the way I contend. A proof, it has been ſaid, might eaſily be adduced:—Fill the carotid, at that place where it is giving off no branches, with quickſilver, and let us ſee if any part of it, under the preſſure of a large column, gets into the abſorbents. If it gets in, we allow this doctrine; if it does not get in, it muſt fall to the ground! This does not follow. The ureters are inſerted into the bladder, and bring the urine into it from the kidneys; yet neither water, nor air, nor any other injection, will paſs from the bladder into the ureters in their natural ſtate; this happens from the obliquity of the inſertion of their orifices, which run for ſome way between the muſcular and internal coats of the bladder, before they open into the cavity; and we do not know that there may not be a ſimilar contrivance in the inſertion of the mouths of lymphatics in the cavities of arteries and veins; which, conjoined to their not acting but from a particular ſtimulus, may fully ſolve the phænomenon. The lymphatics, which ariſe

from the interior ſurfaces of the arteries and veins, may have their orifices of ſuch a nature as to be capable of taking fluids into them, or ſhutting themſelves, and not receiving fluids, except in certain circumſtances. It has already been ſhown, that it is very improbable that they are not terminations of arteries, neceſſarily receiving fluids propelled by the force of the heart and arteries.

CHAP. XI.

Orifices of the Lacteals and Lymphatics.

THE ancients ſpeak of the mouths of arteries and red veins, and of an abſorption performed by theſe mouths, with great confidence. One would ſuppoſe, from reading the paſſages formerly quoted from Hippocrates and Galen, that they had certainly ſeen them: nothing, however, is more certain, than that the naked eye does not diſcover any diſtinct terminations of arteries, or beginnings of veins. Theſe are loſt in minuteneſs and number. The microſcope only diſcovers ſome of theſe, in particular parts of living animals; it diſcovers the termination of arteries in veins, and of courſe, the beginnings of the veins: but the microſcope itſelf has not enabled us to diſcover the orifices of the exhalent branches of arteries. As the ancients, then, had not the advantage of theſe inſtruments, they could not poſſibly ſee the termination of arteries in veins; indeed, they never once ſuſpected any ſuch termination, as it is now underſtood, much leſs could they ſee the orifices of the exhalent branches of arteries; and the veins, as has been already proved, have no inhalent orifices. Some of the moderns have, from anatomical injections of arteries and veins in the dead body, inferred

inferred the exhalent orifices of arteries and the inhalent orifices of veins. How little these injections are to be depended on, I have already shewn, and that the fluid injected, escaping into cavities and on surfaces, from the arteries and veins, might be transudation only. Others have asserted, that they have actually seen these orifices by means of the microscope, and have either seen the injected fluids run out from them on surfaces, or hanging in their mouths. Among these are Leiberkuhn and Mekel. The former inserted injecting tubes into the trunks of the arteries and veins of the intestines, filled these with fluids coloured differently, and, having exposed the villi belonging to these arteries and veins to the microscope, by gradually elevating the tubes from a horizontal to a perpendicular state, says he saw the fluids, by their own gravity, appear in the arteries and veins, and presently run out, at their exhaling and inhaling orifices, into the cavities of the ampullulæ or bulbous beginnings of the lacteals. His words are: "Nonnulli autem rami arteriarum et venularum supra descriptarum, trunculis his suis longe minores, perforant bululam lactei, et in hanc, apertis osculis, hiant." And again, speaking of the same vessels, he says: "Ramulus arteriolæ in cavum ampullulæ vasis lactei penetrans—Venosum ramulum in cavum ampullulæ lactei hiantem."—As it is certain, however, that he was deceived respecting the ampullula itself, so it is certain he must have been respecting these orifices. I have injected the villi of the human intestines with quicksilver to the greatest minuteness, but never saw a particle pass out from the extremities of the blood-vessels. Professor Mekel's absorption by red veins has already been disproved. If the orifices of the exhalent branches of the arteries have not been seen, it may be said, whence do anatomists infer that such orifices exist? I have already touched on this subject in my remarks on transudation, and shall only add to what I have there said, that the phænomena of bloody sweat, and the menstrual flux, transferred to the skin, appear to prove, that there must be such orifices there, and of course every where else. The warmest supporters of transudation have only asserted, that the thinnest part of the blood transuded through inorganic pores in the coats of arteries and veins, but never that the red part of the blood did so. Now it may be proved, that the discharge of blood referred to is, in the first place, from

from the arteries; and, in the next place, is not from rupture of thoſe veſſels. That the ſweat is diſcharged by the arteries, nobody has ever doubted: they are the only veſſels which carry fluids towards the ſkin. The red veins and lymphatics have their fluids paſſing in the oppoſite courſe, that is, towards the heart or centre of the vaſcular ſyſtem. If blood is diſcharged with the ſweat, it muſt be from the ſame veſſels which throw out that fluid. That the menſtrual flux is a diſcharge from the arteries of the uterus, was a diſcovery of Dr. Hunter. No where are arteries more eaſily diſtinguiſhed from veins, than in this viſcus: the arteries are there convoluted or curling; the branches of the veins are much larger, and are not convoluted. It happened that a woman died when her menſes were flowing: Dr. Hunter examined the internal ſurface of the uterus, found it exceedingly red and loaded with blood; that the principal redneſs was from the diſtended and convoluting arteries. He preſſed forward the blood, which was fluid, and which, he aſſerted, never coagulated, and ſaw it appear on the ſurface near the extremities of theſe arteries. As this diſcharge happened inſtantly, and from the gentleſt preſſure of the finger, it could not be tranſudation, which always requires time; it could not be rupture of veſſel. I have had ſeveral opportunities of repeating this experiment, which always ſucceeded in the ſame manner. Now, if this diſcharge is from the arteries in the uterus, there can be little doubt but that it is alſo from the arteries, when it is transferred to the ſkin.—That neither of the diſcharges is from ruptured veſſels, is demonſtrated from the regularity of the phænomena. In the transferred menſes (which I have ſeen more than once, and have been informed by Dr. Hunter that he had ſeen ſeveral times, beſides that it has been mentioned by Haller, Boerhaave, and others) the blood appears gradually, continues to flow regularly and ſlowly, comes periodically at the uſual time of the menſes, laſts the common time, and gradually diſappears. This could never be the caſe in hæmorrhage from ruptured veſſel. Hence then the exiſtence of exhalent orifices in arteries is inferred. Now, as theſe orifices have never been ſeen, and, as I have already obſerved, are loſt in minuteneſs and confuſion from their number, ſo I almoſt deſpaired of ever ſeeing the orifices of lacteals and lymphatics. What made me think it

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at all poſſible, was, that theſe veſſels ſometimes take up the red particles of the blood, which are very diſtinctly ſeen in the microſcope; the orifices, therefore, through which they enter muſt be ſtill more viſible. It occurred to me, that the place where there was a poſſibility of ſeeing them, was likely to be the villi of the inteſtines; a greater abſorption takes place on that ſurface, the veſſels are in proportion larger; beſides, they hang out from the ſurface in diſtinct packets, and reſemble hairs, or the pile of velvet, from whence they have been termed villi. The lacteals and the arteries are generally empty in the dead body, and the lacteals are collapſed and inviſible when there is no chyle or lymph in the inteſtines. The ſtate of the villi muſt then be different from that in the living and abſorbing inteſtine. Of courſe, they muſt be liable to diſtenſion and collapſe. In order, therefore, to ſee the orifices of the lacteals, it naturally occurred to me that the villi muſt be in the diſtended ſtate. The arteries are always empty in the dead body; and, as the lacteals continue only for a little time to propel their contents after the death of the ſyſtem, and are alſo generally empty, it muſt be a matter of uncommon accident to find them in the ſtate of diſtenſion, and proper for microſcopical examination. That accident, however, actually happened. A woman died, in conſequence of convulſions after lying-in, about five in the morning. She had been in perfect health the preceding evening, and eat heartily at ſupper. The lacteals were diſtended with chyle, which here formed a firm coagulum; many of the villi were turgid with the ſame chyle, and reſembled white veſicles. This was a new appearance to me. I have ſince found, however, that other anatomiſts had ſeen the ſame thing. Haller, after mentioning thoſe who prior to him had ſeen the villi loaded with chyle, ſays, "Et ego inque homine villos albicantes & chylo plenos vidi." It was on theſe, that, for the firſt time, I ſaw the abſorbent orifices of the lacteals: but, before I deſcribe them, I ſhall endeavour to point out what other anatomiſts have aſſerted on this ſubject.

Aſellius ſeems to have ſeen ſomething of the ſame appearance of villi in quadrupeds; for, ſpeaking of the lacteals, and their orifices, he ſays, "Ad inteſtina inſtar hirudinum hiant ſpongioſis capitulis." His account of their orifices, from his own words, appears to be imaginary; and accordingly has been conſidered as ſuch by ſucceeding anatomiſts,

miſts, who, aſſiſted by their beſt microſcopes, could not find theſe orifices.—Haller, ſpeaking of the abſorbing orifices of the lacteals, concludes, "Particula de qua Ruyſchius deſperaverat & Lyſterus & ipſe demum microſcopiæ artis magiſter A. V. Lewenhoeck."—Ruyſch's words are, "Venæ autem lacteæ primi generis oriuntur ex inteſtinis tam ſubtili principio ut ineffabile id, & incredibile ſit, ita quidem ut tomentoſa horum exilitas abſolute non poſſit ulla figura depingi."—Leiberkuhn has been conſidered by ſome as the diſcoverer of the orifices of the lacteals. Having deſcribed the arteries and veins of the villus, he comes to its lacteal, which, he ſays, ariſes out of an oval veſicle, having a little hole in its extremity. "Ramuſculus vaſis lactei extenditur in ampullulam vel veſiculam ovulo haud abſimilem, in cujus apice forammulum quoddam exiguum microſcopio detegitur." Sometimes he diſcovered more than one perforation in the ampullula: "Quod autem unum ſaltem adſit forammulum in cujuſvis ampullulæ apice, certo examine mihi conſtat: interdum tamen licet rariſſime plura, ut in papillis mammarum, vidiſſe memini." This ampullula he deſcribes as filled with cellular membrane, or forming a ſpongy cavity. He ſays it has an artery and a vein opening into its cavity, and that it abſorbs the chyle, and gives it to the lacteal. His account of the opening of the artery and vein into the ampullula, I have already noticed; the ſpongy cavity he thus deſcribes: "Infles per arteriam vel venam meſentericam, partem inteſtini per duos annulos metallicos interceptam, aditu arteriæ vel venæ libero manente—penetrabit aer, per vaſa deſcripta, in cavum villorum; diſtendet hos, & ex his per forammula in apice bullularum exibit. Si ceſſas flando, collabuntur iterum villi; ſed ſi continuas, quod applicatione follis facile ſit, donec exſiccaveris, diſtenti manebunt. Tunc cultro raſorio acutiſſimo finde villos, et videbis microſcopio, eorum cavum impletum eſſe materie quadam ſpongioſa vel celluloſa." Haller doubts his deſcription, for he ſays, "Ea ampullula, quod notatu dignum eſt, celluloſo textu videtur repleri." But preſently adds, "Niſi forte circumpoſita fuit tela." From what I have ſaid of tranſudation, the reader will eaſily diſcern how incompatible his experiments, and the concluſions he draws from them, are with what has been offered on this ſubject. They were made in the dead body, which permits even air to tranſude. The veins have certainly

no open mouths on ſurfaces; and he confounds the whole villus, with its arteries, veins, nerves, lacteals, cuticular covering, and cellular membrane, with the imaginary ampullula. Mr. Hewſon alſo rejects the ampullula; and, ſpeaking of the villi of the inteſtines, ſays, "This is the only circumſtance, concerning theſe parts, in which I ſhould differ from this very accurate obſerver, whoſe experiments in ſupport of his opinion, about this ampullula, ſeem to be liable to fallacy," &c. He not only never ſaw any thing, in the villi of the human inteſtines, like an ampullula, but, from his injections of the lacteals on the ſame villi of the inteſtines, in birds, in turtle, and in fiſh, where they form no ampullula, and only a net-work, like the other veſſels, is ſtrongly diſpoſed, from the analogy, to diſbelieve this aſſertion of Leiberkuhn's. Mr. Hewſon's words are, "Since the experiments, from which the villi of the human ſubject were ſuppoſed to contain an ampullula, are ſo equivocal, and ſince the villi can be proved in the other claſſes of animals, *viz.* in birds, fiſh, and the amphibia, to have net-works of lacteals, as well as of arteries and veins, the probability is in favour of their having the ſame ſtructure in the human ſubject." Though Mr. Hewſon rejects the ampullula of Leiberkuhn, he ſays nothing ſatisfactory concerning the orifices of the lacteals. He ſays, "I have ſome preparations by me, adapted to the microſcope, in Leiberkuhn's manner, in which I think I can clearly ſhew the orifices of the lacteals on the extremities of the villi, where there appears ſometimes to be one, and ſometimes to be more orifices. In ſome parts of the ilium, where the injection of the arteries and veins had run more minutely, the villi appeared diſtended; and, inſtead of being broad and thin, were more round and cylindrical, and the extremity ſeemed ſpongy and porous." And afterwards, he ſays, "It might here be objected, that theſe were only lacerations of the villi; but I am perſuaded they were not, from having, on repeatedly examining them, obſerved the pores or orifices very diſtinct, and empty." Here it is evident, that the arteries and veins only were injected; and, as the lacteals were not, he could not ſay, in any other way than that of mere conjecture, what theſe pores were. I have mentioned the caſe where I firſt ſaw the villi white from the abſorbed chyle. I have frequently ſeen them ſo ſince, but never ſo well as on that occaſion. The obſervations I then made were,

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1. Many of the villi were ſo full of chyle, that I ſaw nothing of the ramifications of the arteries or veins; the whole appeared as one white veſicle, without any red lines, pores, or orifices whatever.

2. Others of the villi contained chyle, but in a ſmall proportion; and the ramifications of the veins were numerous, and prevailed, by their redneſs, over the whiteneſs of the villi.

3. In ſome hundred villi, I ſaw a trunk of a lacteal, forming or beginning by radiated branches. The orifices of theſe radii were very diſtinct on the ſurface of the villus, as well as the radii themſelves, ſeen through the external ſurface, paſſing into the trunk of the lacteal: they were full of a white fluid. There was but one of theſe trunks in each villus.

4. The ſpongy cavity, which Leiberkuhn ſpeaks of, appeared clearly to be the common cellular membrane, connecting all the arteries, veins, nerves, and lacteals together.

5. The orifices on the villi of the jejunum, as Doctor Hunter himſelf ſaid (when I aſked him, as he viewed them in the microſcope, how many he thought there might be) were about fifteen or twenty on each villus; and in ſome I ſaw them ſtill more numerous. I have, on a former occaſion, deſcribed theſe orifices as appearing in a bulbous extremity of the lacteal; but repeated examinations of the villi, under ſimilar circumſtances, have now taught me the real ſtructure of their orifices and primary branches. They ariſe out of the lymphatic glands exactly in the ſame way, that is, by ſmall orifices belonging to radiated branches, which preſently unite to form one veſſel. Every effort I have made to detect the orifices of the lymphatics, has hitherto been ineffectual. I have looked for them on the villi of the lips, villi of the toes and fingers; but we have not there the opportunity of finding them filled with a white fluid, as in the inteſtines. This circumſtance, however, when it is conſidered that lacteals and lymphatics are the ſame veſſels, is probably of no conſequence. There may be ſome little variety, but the orifices and beginnings we may conſider, from ſo great analogy in other reſpects, as very much reſembling each other.

CHAP.

CHAP. XII.

Of the Coats, Irritability, Muſcularity, Vaſa Vaſorum, and Senſibility, of Lacteals and Lymphatics.

ANATOMISTS have found, that the ſubſtance of the larger arteries may readily enough be ſeparated into three ſtrata; to theſe they have given the name of coats; and ſpeak of an external, internal, and middle coat of an artery. The ſubſtance of which the larger red veins are formed, may likewiſe, though with more difficulty, be ſeparated into coats. Theſe coats become thinner, the farther we go from the beginning of the trunks, till at laſt it is no longer poſſible to ſeparate them in the branches, and their exiſtence is only inferred from analogy. Of the coats of arteries, two are commonly fibrous; in which reſpect they reſemble the ſubſtance of the muſcles: the internal coat has no viſible fibres.

The anatomiſts, till the time of Nuck, conceived the lymphatic veſſels to have but one coat, and that ſimilar to the internal one of arteries and veins, that is, without any viſible fibres. Nuck was the firſt who aſſerted, that their coats were alſo fibrous, and demonſtrated this in the thoracic duct of horſes. I have repeatedly demonſtrated theſe fibres in the ſame duct, and have now an engraving of them in my poſſeſſion. I have alſo contrived a method of demonſtrating that it has at leaſt two coats; for I inverted a portion of the duct, and drew it on a glaſs cylinder; the cylinder was ſomewhat larger than the portion of the duct, and, as I expected, the internal coat tore, and ſhewed the outer one entire under it. I have ſometimes ſeen fibres in the human thoracic duct, when it happened to be uncommonly large; but more generally, even in this trunk of the abſorbents, no fibres are to be ſeen. The muſcles of the more perfect animals are all fibrous, and therefore the anatomiſts frequently infer muſcularity in parts, from the preſence of fibres; but they are by no means a certain mark of muſcu-

larity. The tendons, aponeuroſes, bones, cellular membrane, brain, and nerves, are all of them fibrous, but not at all muſcular. On the other hand, as the ultimate or conſtituent fibres are inviſible in the beſt microſcope, parts may be fibrous and muſcular, though they appear otherwiſe to us; or they may have contractile power, without being fibrous. Voluntary motion is a certain proof of muſcularity; now we ſee this motion in animals barely viſible in the microſcope. If the whole animal is juſt viſible, the muſcular fibres, of which it is compoſed, muſt be inviſible. Another proof we have of muſcularity in a part of a living animal, is the diſpoſition it has to be acted upon by a ſtimulus, ſo as to be made to contract and relax every time it is applied to it. This diſpoſition we call irritability; and the actual contracting and relaxing is muſcular motion. By this teſt we ſhall be able to prove, that the lacteals and lymphatics are irritable and muſcular. They not only empty themſelves quickly on the admiſſion of cold air, but, when touched with oil of vitriol, or ſimilar ſtimulants, contract through their whole length, as muſcular fibres are known to do from ſuch applications. Haller appears to have paid great attention to this ſubject, and convinced himſelf fully of the fact:—" Sed etiam in vivo animale, aut nuper mortuo, non ſolus ductus thoracicus, qui vere de genere vaſorum lymphaticorum eſt, et perinde vaſa lymphatica hepatis, ad olei vitrioli tactum contrahuntur, et celerrime exinaniuntur, ſed imprimis in animale cui plena fuerunt, aut chylo, aut lympha, aut cæruleo liquore quem animalia abſorbere coegi, ſub ipſis intentis meis oculis, toties vidi hæc ſive lymphatica vaſcula ſive lactea evaneſcere: non potuerunt autem viſui ſe ſubduxiſſe, niſi expulſo qui replebat et conſpicua reddebat liquore lympha lacte indigo in aqua diſſoluto." In Mr. Hunter's experiments, the lacteals abſorbed the fluids thrown into the inteſtines, independant of any communication by the nerves with the brain whatever; for the trunks of the nerves of that part of the inteſtines and meſentery were, with the trunks of the arteries, then encloſed in a ligature. The muſcular fleſh of the turtle continues to contract and relax, from the ſtimulus of the air only, many hours after the animal's head is cut off. The abſorbents appear to me to have a ſimilar power of action, and to be capable of abſorbing for ſome time after the animal is dead. Malpighi had before ſaid, that one would be tempted to believe that they abſorbed after death, and I was determined to make the experiment. I

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tied up the trunks of the arteries and veins belonging to a portion of the great inteſtine in an aſs, which had been dead a few minutes (the inteſtines were ſtill in the cavity of the abdomen, and the parts not cold.) I knew that the trunks of the abſorbents muſt be encloſed in the ligature, though not one of them was then viſible. Two hours after I returned, and found a number of abſorbents turgid with a tranſparent fluid. I opened one of the largeſt with a lancet; the fluid iſſued in a ſtream, which it could not have done, unleſs the veſſels had continued to abſorb, and to propel their fluids with great force, after the death of the ſyſtem.

Lymphatics and lacteals, then, have coats, which are irritable and muſcular. It will be preſumed, they are alſo vaſcular: we can demonſtrate that they are ſo. That the coats of arteries and veins are themſelves vaſcular, has been long known. Anatomiſts not only ſaw the little arteries and veins full of blood in the recently dead body, but they injected them with coloured fluids, from the cavities of the trunks on which they ramified. They termed theſe veſſels vaſa vaſorum. I do not find them deſcribing lymphatics amongſt the vaſa vaſorum. I have ſeen the aorta, however, almoſt through its whole length, covered with theſe veſſels, which I had injected with quickſilver. It is even uſual for the trunks of the abſorbents to make grooves in the coats of arteries: they are alſo often ſo numerous, as to conceal them entirely in their ramifications. The lymphatics and lacteals themſelves have their vaſa vaſorum. I have injected, in quadrupeds, the arteries on the coats of the lymphatic veſſels, and ſeen them ramifying very elegantly through their ſubſtance. Theſe arteries muſt have their correſponding veins, and I can have no doubt of their being attended with lymphatics. The red lines which appear under the ſkin, when poiſons are paſſing into the blood from the ſurface of the body, furniſh us with another proof of the vaſcularity of their coats. The courſe of theſe lines, and the ſubſequent inflammation of the gland, ſhow theſe to be inflamed lymphatic veſſels. How could they inflame, if they were not vaſcular? It has been objected, that theſe red ſtreaks alluded to cannot be lymphatic veſſels, from the circumſtance of their frequently having conſiderable breadth, whilſt the diameters of the ſuperficial lymphatics are known to be very ſmall; but thoſe who make this objection forget, that, though the poiſon enters at firſt one veſſel only, yet, from the

the anaſtomoſis of theſe veſſels, it preſently pervades a number of parallel branches, and inflaming them all, produces the breadth of the red ſtreak. They ought likewiſe to attend to this circumſtance, that the inflamed lymphatics, from the well-known ſympathy in ſurrounding parts, become a cauſe of inflammation, not only in the inveſting cellular ſubſtance, but in the ſkin which covers them. I have ſometimes, however, ſeen the inflamed lymphatic putting on no other appearance than might have been expected from a ſingle veſſel only being thus affected.

Having thus conſidered the vaſa vaſorum of lymphatics, we come next to enquire whether the nerves alſo ramify on their coats, or what intercourſe appears to take place between the abſorbent and nervous ſyſtem. The nerves are found either forming net-work on the coats of arteries, encloſing them in the form of rings, or making ſemicircular turns round their great trunks: accordingly, their actions are very much influenced by the ſtate of the mind and brain. Thus, from a particular ſtate of the mind, the blood is determined to the face in bluſhing, or called from it in fear. In the one ſtate it becomes red, in the other pale. Anger not only occaſions a ſimilar determination of blood to the face, but quickens and makes irregular the pulſations of the heart and arteries. The veins do not appear to have ſo much intercourſe with the nerves as the arteries; and the reaſon, I apprehend, is, that the veins are more paſſive, and their action is in a great meaſure governed by that of the arteries; of courſe, ſo great an intercourſe with the nerves was not neceſſary. The thoracic duct is ſurrounded through its whole length with the ramifications of the par vagum and intercoſtal, but what influence they have on its action I do not know. It did not appear, in Haller's experiments, that any application to the thoracic duct or lymphatics gave pain; and we have already mentioned, that the lacteals performed their functions when the nerves were tied up. Red lines, from the abſorption of poiſon, are ſometimes tender to the touch; but this is from the inflamed ſkin, and not from the lymphatic veſſel. Wounds of theſe veſſels are frequently accompanied with ſymptoms of irritation, as ſhivering, ſickneſs, and vomiting, but with no other pain than what muſt neceſſarily follow from pricking ſome ſmaller nerves at the ſame time.

Theſe veſſels, like arteries and veins, are occaſionally elongated or ſhortened, ſhoot into and ramify through neighbouring parts, and are again withdrawn: the former we infer from the circumſtance of parts growing to one another, in ſuch a manner, that the veſſels of either part, though formerly unconnected, may then be injected from the other, that blood coagulating ſhall become vaſcular from the neighbouring veſſels: the latter we infer from the circumſtance of ſolid tumors occaſionally diſappearing in the living body, with the veſſels which nouriſhed them.

CHAP. XIII.

The Valves of the Lacteals and Lymphatics.

AS ſoon as an abſorbed fluid has got a little way within a lacteal or lymphatic, it is prevented from returning by valves. One is ſurprized to find, that one of the firſt diſcoverers of lymphatics was almoſt entirely ignorant of the valves; and that, after the veſſels themſelves had been deſcribed, both by Bartholin and Rudbeck, the dilucidatio valvularum ſhould have been left for Ruyſch. Bartholin, in his firſt publication on the lymphatics, ſays, "Valvula tenerrimæ texturæ ingreſſui in axillarem ſupra præponitur, quæ regreſſuræ aquæ obſtat. Eaque ſola obſervari poteſt. Non dubito quin alibi quoque venis aquoſis apponantur valvulæ, ſiquidem ne flatum admittant verſus extremum immiſſa, ob tunicæ tamen ſubtilem contextum, cultro anatomico ſeparari non poſſunt." Ruyſch alſo cenſures Rudbeck, for being equally ignorant on this ſubject; though in the firſt edition of his works, which I have met with, he appears to me very diſtinct on this ſubject. "Intus excavata & fiſtuloſa ſunt infinitas habentia valvulas ſemper veſiculam chyloſam ſive ejus ductus adſpicientia, ne humor a glandulis vel aliis partibus exſuctus iterum refluat, quod aprime ligatura oſtendit."

dit." Ruyſch, however, has generally been conſidered as, if not the diſcoverer, the beſt demonſtrator of the valves. Valves are an apparatus nature employs frequently, for the purpoſe of preventing the retrograde motion of fluids, but no where ſo much as in the cavities of lacteals and lymphatics. As the valves of the arteries and veins have been conſidered by anatomiſts as productions of their internal coats, it may have been expected that I ſhould have treated of the valves of lymphatics in the laſt chapter; but it never ſtruck me as a good argument, that becauſe one ſubſtance was ſeemingly continued from or went into another, it was therefore the ſame kind of ſubſtance; for if this was true, muſcle, tendon, and bone would be ſimilar ſubſtances—a concluſion which needs no refutation. A valve is a ſemicircular membrane, or rather of a parabolic ſhape, attached to the inſide of the lymphatic veſſel by its circular edge, having its ſtraight edge, correſponding to the diameter, looſe or floating in the cavity: in conſequence of this contrivance, fluids paſſing in one direction, make the valve lie cloſe to the ſide of the veſſel, and leave the paſſage free; but attempting to paſs in the oppoſite direction, raiſe the valve from the ſide of the veſſel, and puſh its looſe edge toward the centre of the cavity: but, as this would ſhut up little more than one half of the cavity, the valves are diſpoſed in pairs, exactly oppoſite to each other, by which means the whole cavity is accurately cloſed. Their looſe edges are conſtantly turned towards the thoracic duct, or trunk of the ſyſtem, ſo that fluids may paſs towards it, but cannot eſcape from it into the branches. It is principally by means of theſe valves that we ſo readily diſtinguiſh lymphatic veſſels from arteries and veins, or any other veſſel. The arteries have none, except at their beginnings; the veins have none, or next to none, in the brain, viſcera of the thorax, and viſcera of the abdomen. Even on the extremities, where the veins have valves, they are never ſo crowded as in the lymphatics. No other veſſels in the body have valves. I have ſaid that the valves are placed in pairs; they are alſo frequently found interſecting the veſſels, at equal diſtances, about the eighth or ſixteenth part of an inch apart. There is great variety, however, in their diſtribution, in different bodies: the thoracic duct, for example, in ſome bodies, has perhaps only three or four pair of valves; in others, I have ſeen it crowded with valves through its whole length. I have ſeen a lymphatic veſſel run ſix inches, without a ſingle valve appearing

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in its cavity. Sometimes the trunks are more crowded with valves than the branches, and ſometimes I have ſeen the reverſe of this. It is not neceſſary to open the veſſels, in order to diſcover the valves; they are ſufficiently marked on the outſide, and give the veſſels the appearance of being notched or jointed in different places. The lacteals are generally ſtrongly marked in this way, which makes them at times reſemble a ſtring of beads. In the lymphatic veſſels of quadrupeds, this appearance is alſo very remarkable: nor is there the leaſt reaſon for cenſuring Ruyſch and Nuck on this ſubject, as having, in their engravings, very much exaggerated it. Wherever a lymphatic veſſel enters a vein, there is always a valve, and moſt commonly a pair, to prevent the blood from paſſing from the vein into the lymphatic veſſel. The ſame valves are to be obſerved when a lymphatic veſſel joins the thoracic duct, to prevent the contents of the thoracic duct from paſſing retrograde into the branches. It is from this circumſtance that the thoracic duct, injected with wax, appears as a trunk without any branches; and that, when injected with quickſilver, and viewed with a magnifying glaſs, it appears externally rough and tuberculated: the tubercles are the projections made by the valves, at the beginnings of the branches. In the red veins we ſometimes meet with three or four valves, inſtead of two, in one place. In the lymphatics I never ſaw more than two; and frequently, where a lymphatic enters a red vein, there is but one valve.—The thoracic duct itſelf was thus deſcribed by its inventor Euſtachius, as we have ſeen:—"Oſtiolum ſemicirculare in ejus origine," is the expreſſion he employs. This I have ſeen in quadrupeds, but never in the human ſubject, where there are conſtantly a pair of valves. This deſcription, however, has confuſed other anatomiſts. Haller, in particular, ſeems indetermined in a matter of the greateſt ſimplicity. In his deſcription of theſe valves, he ſays, "Ipſa autem valvula membranas habet a ductu chylifero undique in venam procurrentes ad circularis hymenis ſpeciem, quem pro duabus valvulis potius quam pro una ſemilunari habeas." The vaſt number of valves not only diſtinguiſh and characteriſe the abſorbent veſſels from all others in the human body, but alſo in quadrupeds, birds, amphibious animals, fiſh of warm blood, as they are ſtiled, and even in fiſh of cold blood. Mr. Hewſon ſays nothing of the valves in the lymphatics of birds, in that part of his

book where he particularly describes the system; but in another part of the same book, speaking of injecting the villi of the intestines in birds, he says, "the experiment is more difficult, because their lacteals are full of valves, and their villi are small, compared to those of the turbot: nevertheless, I have succeeded, in getting the valves to give way, so as to fill a few of the lacteals distinctly enough to be seen to divide into branches upon the villi."—In the turtle they are very evident in the lacteals on the mesentery, and with some difficulty forced, by pressing the quicksilver injected from the trunk, but stopt by the valves, pretty firmly, with the finger close to the valves, and in the direction of the intestines. In this way I have often ruptured the valves, without rupturing the vessels, and made the injection pass into the lymphatics of the intestines. In the porpoise, the valves of the lacteals are exactly as in quadrupeds, or perhaps still more numerous; so that it is not possible to inject these vessels otherwise than in the course of the chyle, that is, on the side of the intestines.

Mr. Hewson, notwithstanding his describing particularly the lymphatic system in fish of cold blood, was not certain whether the lymphatics had valves or not. He says, "These vessels in fish either have no valves, or the valves readily give way; for it is an easy matter to fill them contrary to the course of the lymph." I have a preparation of the stomach of a skate, in which I first injected the arteries and veins, and last of all the lymphatic vessels; but I was obliged to inject them in the course of the lymph; and the injected vessels appeared to have valves, in the same manner as the lymphatics of other animals. For my own part, I should not easily believe any vessel to be a lymphatic, where the characteristic of valves is wanting. I had once an opinion, that the intention of the valves, in the absorbents, was not only to prevent retrograde motion in the absorbed fluids, but to intersect the column of the fluid, and prevent the pressure of the whole fluids in the vessel from affecting chiefly its lower extremity; the consequence of which would be dilatation and varix at that place. I am not certain that this opinion is not well founded; for the red veins of the lower extremities, which sustain the longest column of blood, are more frequently varicose than any other in the body, those of the arm being in proportion very seldom affected. Accordingly, I conceived, that if this opinion was just,

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the valves would be more wanted in animals who were more frequently in an erect poſture, as their lymphatics would neceſſarily be obliged to ſupport a greater weight of fluids than thoſe of animals who were generally in a horizontal poſition; and I thought this opinion confirmed, by finding that the thoracic duct in horſes has few valves, compared with the ſame duct in monkies, where it is quite crowded with them. But when I came to conſider, that in the turtle and porpoiſe, who are more commonly in the horizontal poſture, the lymphatics were nevertheleſs crowded with valves, I became leſs ſatisfied; eſpecially as the valves muſt all be open when the fluid is paſſing forward, and therefore the preſſure of the whole column muſt be acting at that time.

Dr. Hunter once met with a body, where the valves were ſo ill adapted to the diameter of the veſſels, that they allowed air to paſs contrary to the courſe of the abſorbed fluids. He inflated all the lacteals on the inteſtines from the thoracic duct; and, ſuppoſing that he could do this again when he pleaſed, neglected the opportunity of filling them with quickſilver. The ſame accident happened to Marchellis, according to Haller's account, who mentions it thus:—"Qui, inflato chyli receptaculo, omnia in toto corpore animalis pellucida vaſcula aere diſtendit." And he uſhers in this caſe, by the obſervation of "Non ſemper fidæ cuſtodes valvulæ."—He obſerves alſo, that ſimilar, unexpected, and uncommon retrograde motion of fluids, injected into the abſorbents, had happened under his own eye. He particularly mentions his having injected the abſorbents of the lungs (vaſa concatenata reticulum facientia) from the ſuperior part of the thoracic duct. It has been very ſeldom that any thing of this kind has occurred to me; and, though I do not deny that it may ſometimes happen in the dead body, yet I doubt very much if ever it happens in the living. In the diabetes, it has been ſuppoſed that the chyle flows retrograde from the thoracic duct into the lymphatics of the kidney; from them into the cryptæ, ſo into the tubuli uriniferi, thence into the infundibula pelvis, ureter, and ſo into the bladder. This opinion is mere ſuppoſition, depending on no experiments; and, beſides that all ſuch opinions ſhould be rejected; why ſhould the chyle flow retrograde in the lymphatics of the kidney, and not in the lacteals themſelves? and why are not the fæces fraught with a ſimilar fluid, as well as the urine? The arteries of

the kidneys are on theſe occaſions præternaturally enlarged, particularly thoſe of the cryptæ, or minute glands which ſecrete the urine; and it is infinitely more probable, that the fluid of the diabetes ariſes from ſome remarkable change in the veſſels uſually ſecreting the urine, than from any imaginary retrograde motion of the chyle through the lymphatics of the kidnies.

CHAP. XIV.

The Lymphatic Glands.

I Formerly obſerved, that Herophilus was ſuppoſed to have ſeen the lacteals, becauſe he deſcribed veins on the meſentery, which did not, like the greater number, terminate in the liver, but, εις αδενωδη τινα σωματα, in certain glandular bodies. Theſe bodies are, in fact, as much a part of the abſorbent or lymphatic ſyſtem, as the ganglions are a part of the nervous ſyſtem. Scarcely have the lacteals left the inteſtine, and reached the meſentery, when they enter theſe glands. The Latin medical writers have termed them glands, from ſome ſuppoſed reſemblance to nuts; and in our vulgar language this idea appears to be ſtill kept up, for they are commonly termed kernels. Theſe bodies are not only found on the meſentery, but in a great many other parts of the body. Their number is various in different bodies. As the lymphatics and lacteals, of which they form a part, were not known to the ancients, one is not ſurprized to find them aſſigning to theſe glands the ridiculous office of ſupporting, like ſo many cuſhions, the larger blood-veſſels, at thoſe places where they were dividing into ſmaller branches: and indeed, though we know ſomething more of their nature, and ſtructure, and diſeaſes, we know no more of their real uſe than the ancients. As they inform us, however, of

the paſſage of infectious matter into the blood; and as from their ſtate we are enabled to judge of the preſence or abſence of other diſeaſes; the knowledge of them is of great importance in the practice of medicine; and it becomes neceſſary to deſcribe them on theſe accounts, as well as that the deſcription of the lymphatic ſyſtem would be imperfect, without a particular account of the glands. Theſe glands are generally of an oval ſhape; and are of various ſizes, from the twentieth part of an inch to about an inch in diameter: from diſeaſe they frequently become four or five times that ſize; now and then ſtill larger. Their ſhape is not always oval; ſometimes they are globular, ſometimes round and flat, ſometimes of a triangular figure; and in quadrupeds, frequently, they are collected and cluſtered into one maſs, ſo as to reſemble their pancreas. It was this circumſtance which miſled Aſellius, and made him miſtake the conglomeration of the lymphatic glands, at the root of the meſentery, in dogs, for another pancreas; which the anatomiſts, for ſome time after, diſtinguiſhed by the name of Pancreas Aſellii. This conglomeration of lymphatic glands ſometimes takes place in the human body. I have found the lymphatics of the legs terminating chiefly in one gland, in place of terminating, as uſual, in twelve or twenty, as may be ſeen in the figure annexed. The colour of the lymphatic glands is alſo various in different parts of the body, and on different occaſions. In the younger animal, even on the meſentery, they have more of a red colour, and become paler with age. Immediately under the ſkin, they are redder than within the abdomen or thorax; and, like the external muſcles, are alſo ſtronger. The glands of the thigh or arm will ſuſtain a large column of mercury without burſting; whilſt the glands on the meſentery, or on the lumbar vertebræ, eaſily burſt. In this reſpect, theſe laſt reſemble the viſcera of the abdomen and thorax, whoſe texture is much more delicate and tender than that of the external muſcles. The glands at the root of the lungs are commonly of a blue colour. Some have ſuppoſed this colour depended on that of the ſubſtance of the lungs, which is very frequently blue. They have ſaid, that this ſubſtance is perpetually changing: the abſorbents remove it; and, in its paſſage through their glands, it gives them the blue colour. I do not object to the ſuppoſition of the ſubſtance of the lungs being conſtantly changing, or that it is abſorbed by the lymphatic veſſels, and paſſes through

through their glands; but I conceive this change to take place ſo ſlowly and gradually, and in ſuch minute particles, at the ſame time they are blended with ſuch a quantity of common lymph, tranſparent and colourleſs, that it is impoſſible their colour can ever be owing to ſuch a cauſe. The glands at the root of the lungs are alſo frequently black; and another conjecture has been formed, reſpecting the cauſe of their blackneſs. Theſe glands, it has been ſaid, often pour out an ink-coloured fluid, when cut into. This I have frequently ſeen. They alledge this to be owing to the particles of ſoot floating in the atmoſphere of great cities, which being abſorbed by the lymphatics of the lungs, paſs through their glands, are ſomehow or other detained there, form obſtructions, occaſion a flaccid and diſſolved ſtate of the glands, and are the cauſe of the blackneſs of their contents. This appears to me a very weak opinion. The glands are but ſeldom black, even in thoſe who have lived to a great age in large cities. I ſhould not doubt of their being black in thoſe who have lived all their days on mountains: and the colour of the glands, in my opinion, is no more to be accounted for, in the caſes mentioned, than the colour of the lungs themſelves, which are ſometimes red, ſometimes grey, and ſometimes blue. The colour of the glands may vary from the colour of the fluids at that time paſſing through them. Thus, at the time of the abſorption of the chyle, the glands on the meſentery are whiter than at any other time—as white as milk itſelf. When the chyle is not paſſing through them, nor detained in them, they are paler; but never ſo red as thoſe immediately under the ſkin, or on the outſide of the trunk of the body. In caſes of jaundice, the abſorbent glands in the vicinity of the liver are frequently very yellow, from the abſorption of bile. I do not recollect any caſes, but ſhould believe they were alſo redder, when extravaſated blood was abſorbing from cavities, and paſſing through them. In ſcrophulous inflammation of the lymphatic glands under the ſkin, not only the integuments, but the glands themſelves, have frequently a blue or purple colour; this is owing to the ſlow motion of the blood, both in the arteries and veins, or perhaps even to its ſtagnation in thoſe parts, peculiar to this kind of inflammation. I have ſeen the blood coagulated, and giving a blue colour to the umbilical arteries of a child, who died ſix weeks after it was born. This blood had remained there during the whole of this period.

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The glands have been ſaid to diſappear in old age. Morgagni, Ruyſch, and other celebrated anatomiſts, taught that the glands not only enlarged in the younger animal, in a certain proportion to the growth of the body, but that, after the middle of life, they were gradually diminiſhing, and at laſt vaniſhed entirely. Haller alſo maintains the ſame doctrine: — "Denique etiam in hoc ſucco glandulæ meſentericæ cum lymphaticis conveniunt; nam et ipſe exareſcit per ætatem, & telæ celluloſæ filamenta nunc robuſtiora vaſcula glandularum meſentericarum adtrahunt arctantque, ut neque perinde humoribus ſuis perflui poſſint, neque ab inciſore repleri, & demum ſtrigoſæ glandulæ & complanatæ cumque tela celluloſa confuſæ evaneſcant. Dudum ſe abſque lacteis vivere Ruyſchius ſolebat dicere." The meſenteric glands of old people undoubtedly diminiſh; but that they entirely vaniſh, or that a period ever arrives when the lacteals ceaſe to abſorb, during life and health, as Ruyſch maintained, is highly improbable. I never ſaw a meſentery, even in the oldeſt perſon I have opened, where the glands, though ſmaller, were not equally numerous with thoſe in younger bodies. The glands in the groin, arm-pits, and neck, never vaniſh in the oldeſt bodies I have ever had an opportunity of opening. One cannot ſee any good reaſon for the diſappearing of the glands on the meſentery, and not every where elſe.

The glands are externally ſmooth, and have a ſhining ſurface; this they owe to an external coat, not fibrous, nor eaſily ſeparated from them. Dr. Hunter would not allow this coat to be any thing elſe than condenſed cellular membrane, ſimilar to that which is found between the breaſts of women and the pectoralis major, and which has been deſcribed by ſome anatomiſts as the capſule of the mamma. By this coat they are connected with the ſurrounding adipoſe or cellular membrane, ſo as to be in a certain degree moveable; and in the groin or arm-pits may be drawn down, puſhed up, turned to one ſide or the other. In conſequence of this ſliding motion, like the teſticles in the ſcrotum, they elude any force applied, and are leſs apt to be hurt. When they adhere firmly to the ſkin, or parts below, it is from diſeaſe. Haller makes the coat of the glands ſingle:—"Membrana unica firma duriuſcula." It has always appeared ſo to me. Malpighi deſcribed a ſecond coat, conſiſting of muſcular fibres, under the external one, whoſe uſe, he

he ſaid, was to propel the fluids, otherwiſe liable to ſtagnation in the cells of the glands: but the ableſt of the modern anatomiſts have not been able to find any ſuch fibres. A ſomewhat ſimilar deſcription of the coats of theſe glands has been given by Nuck. My obſervations on this ſubject perfectly correſpond with Haller; who ſays, "Fibras autem carneas habere alii magni viri ad vota ſua forte & phyſiologicas uſus adfirment, neque oculo neque ex irritabili vi unquam confirmare potui; & manifeſto video Malpighianas fibras quas membranæ externæ ſubjectas carnoſas & reticulatas, vir magnus deſcribit, alias ad vaſcula velamenti, alias ad celluloſam telam pertinere. Neque duplex velamentum reperio aut exteriorem membranam, fibroſo-tendineum & interiorem glandulæ quaſi tendinem diſtinguo, cui fibræ internæ inſerantur, quæ ad Nuckii deſcriptionem cum aliqua poetica amplificatione, ut ego quidem credo, fictæ ſunt." This coat adheres to the ſubſtance of the gland by cellular membrane, which alſo connects the different veſſels and particular cells with one another. This cellular membrane is pervaded by a peculiar fluid, which Haller calls ſuccus proprius glandularum. It is principally found in younger animals, diminiſhes as the body grows older, and at laſt totally diſappears. It is of various colours, more frequently white:—"Succum," ſays Haller, "glandulis conglobatis ineſſe album ſeroſum lacte tenuiorem, in juniore animali potiſſimum conſpicuum, id quidem certum eſt." In the glands of the lungs it is of a blue or black colour, but then it is from diſeaſe. This fluid, in the microſcope, appears to have globular particles in it, ſimilar to thoſe which by the ſame means we diſcover in milk. It is moſt probable this fluid is there ſecreted by the arteries, and is totally different from the abſorbed fluids, or thoſe paſſing through the proper cells of the glands. Had it been found only in the glands of the meſentery, we ſhould have ſuſpected it, both from its colour, and containing globules, to be the chyle; but it is found in all the glands, even in thoſe which are at the greateſt diſtance from the meſentery, and out of the road of the chyle. Mr. Hewſon ſuſpected that theſe globules became afterwards the red particles of the blood. This he inferred not only from the globules, but alſo from the circumſtance of the fluid being in greater quantity in young animals, where more blood was wanted; and its diſappearing in old age, where leſs blood was wanted, where new parts were

were no longer forming, and the ſecretions every where diminiſhed. The fact is, we do not know what is the uſe of this fluid.

The arteries of the glands ſometimes form a common trunk, which enters at one end, and ramifies through the whole. This, however, is but ſeldom. More commonly the arteries are many, and come to the glands from all the ſurrounding parts. Theſe ramifications are ſo numerous, that, after a ſucceſsful injection of theſe with ſize coloured with vermilion, the gland appears like an oval lump of vermilion. I have not ſeen the acini, deſcribed by Ruyſch, in theſe glands; and it would appear, that Haller alſo had not ſeen them; for, ſpeaking of this diſcovery, he ſays, "Et neſcio quos acinos preterea." But, as Ruyſch had not ſeen them in any former injection, during a long life ſpent in making anatomical preparations; as he has engraved the glands where he ſaw them; as he ſent the preparation from whence the engraving was taken to the great Boerhaave; and as Boerhaave has deſcribed what he ſaw by the microſcope in theſe glands; I ſhall quote the paſſage:—"Primo, quod arteriæ meſentericæ mitterent ramos ſuos a diverſis locis verſus unamquamque harum glandularum; ita ut non unus ramus peteret illam, ſed varii & multi ab oppoſitis locis, & quod oppoſitis etiam itineribus & directionibus decurrentes in glandulam irent unamquamque. Secundo, quod arteriæ illæ ita a diverſis regionibus miſſæ poſtquam tum veniſſent ad corpus illius glandulæ, ibi quaſi permiſcerentur inter ſe, quamvis tamen manerent vaſculoſæ, idque ubique & per omnes partes. Tertio, quod tandem ſubtiliſſimæ factæ ita confunderentur inter ſe, & innumerabiliorum flexuum varietate in omni puncto intricarentur, ut comparari tantum potuerint cum glomere multorum diverſorum filorum in plexus inextricabiles intricatorum. Neque poſſe hic dici cum ulla veri ſpecie, quod in membrana quadam ordinati hi canales in ſua ſerie ſimplici poſſint videri. Quarto, tandem quod inter hæc intricatiſſima vaſcula & tam ſubtilia multis locis hæreant parvi & multi diſtincti acinuli ut in hepate. Et quantum oculus per microſcopia aſſequitur, ipſi hi acinuli videntur iterum conflari ex minimis pulpoſis extremis plane ſingularibus in ſua fabrica canalibus arterioſis. Nec tamen poteſt videri quod hi acinuli membrana quadam ſingulari ambiantur incluſi." Ruyſch ſays, "Quando jam clarius & perfectius videbam, hæc omnia præ gaudio exſiliebam."

The veins of the meſenteric glands are as eaſily injected as their arteries, becauſe, there, they have no valves. They come to the glands, like the arteries, from every quarter; are larger, and nearly as numerous. On the extremities, where the veins have valves, we have frequent opportunities of ſeeing them in the lymphatic glands, turgid with their own blood; by which means they become as diſtinct as if injected with a coloured fluid. There is ſomething of convolution and interweaving alſo in the finer branches of the veins; ſo that, as Profeſſor Mekel obſerves, "Vaſorum igitur arterioſorum & venoſorum glomer eas ſuſpicatus Ruyſchius excretorios ductus illos putavit vaſorum lymphaticorum ductus."

The readineſs with which theſe glands inflame, alſo points out their vaſcularity. I ſaid, that the coats of the glands were not fibrous or muſcular, that they ſhewed no marks of irritability when touched with oil of vitriol, &c.: but in another way they are very irritable, or quickly excited to action; for Mr. Hunter ſaw the prick of a needle, which never had been uſed before, or touched any infectious or irritating ſubſtances, occaſion the lymphatics of the arm to inflame, and ſhew themſelves in the form of red lines, running towards the axilla; in conſequence of this, ſome one of the glands there alſo inflamed and ſwelled; the patient had rigors and ſickneſs; and all this in the ſpace of a few minutes. I have alſo ſeen ſimilar caſes. The lymphatic glands, independent of thoſe blood veſſels which form their internal ſubſtance, are generally covered externally with a minute net-work of the lymphatic veſſels themſelves. Theſe glands were ſaid, by Boerhaave and others, to be exceedingly ſenſible; of courſe furniſhed with a great number of nerves. The pain which accompanies the venereal buboe probably led them to form this concluſion; for it does not appear that they diſſected the nerves of the glands. The only anatomical fact they ſeem to build on, is the great number of nerves which accompany the ſuperior meſenteric artery. Boerhaave ſays, "The meſentery has but little feeling; it is not muſcular. As the nerves here do not appear to anſwer theſe ordinary purpoſes of giving ſenſation, or ſtimulating to muſcular motion, is it not probable that they exiſt there on account of the meſenteric glands?" into which he ſuſpects they pour a fluid, which makes the chyle more fit for nutrition. Many experiments have been

been made, by Haller and others, ſince the time of Boerhaave, which render this authority, and the opinions of his time, of little weight; parts having been found with little ſenſibility, that were at that time ſuppoſed the moſt ſenſible of any. If the meſentery is wounded, at any part where the nerves are found, the animal ſcreams almoſt as much as when the ſkin is wounded. Again, the nerves appear to be ſent here on two very important accounts; one is, that, forming net-works on the trunks of the arteries, they may regulate the determination of blood to the inteſtines; and the other is on account of the ſenſation which was to take place in the inteſtines themſelves, which we find in the cholic is exceedingly great. On the other hand, Baron Haller contends, from the little feeling of the glands in ſcrophulous ſuppuration, as well as from actual diſſection of the nerves apparently going to the glands, that the glands have no nerves, or next to none:—"Nervi certe perpauci eas glandulas adeunt vix demonſtrabiles etiam quando maximæ ſunt. Ita neque in numeroſis adeo mediaſtini glandulis vel unicum nervum oſtendere facile fuerit, neque in thymo inſigni glandula quæ mollior equidem ſucco tamen ſuo & decreſcente in adultis magnitudine cum his lymphaticis glandulis convenit. Hinc obtuſus harum glandularum ſenſus quoties tument & ſuppurantur, ut in ſcrophulis fit." I agree with Haller, that in the natural ſtate of the glands the nerves can ſcarcely be demonſtrated. I do not know if they enlarge when the glands become ſchirrous; but I once found the nerves very much enlarged in a ſchirrous teſticle. Scrophulous ſuppurations of the glands giving little or no pain, is, however, by no means an argument that they have not conſiderable feeling. In order that an inflammation ſhall be able to give pain, it is neceſſary that its progreſs keep pace with the rate of our ordinary ſenſation. If a gun bullet paſſes through the body with great velocity, it produces no pain, becauſe the rapidity of the motion is greater than that which we have been accuſtomed to judge accurately of. Hence a ſoldier is ſhot in the field of battle, but does not perceive it at the time. On the other hand, the preſſure of a hard body ſhall be ſufficient to produce an ulcer in the ſkin; but we feel no pain till the ulcer is produced, becauſe this is effected by very ſlow degrees, and takes up a conſiderable time. It is for the ſame reaſon that ſcrophulous ſuppuration of the glands gives ſo very little pain.

A lymphatic veſſel, ariſing from the ſurface of the inteſtines or ſkin, or any other ſurface, and terminating in a gland, is termed by anatomiſts the *vas inferens*, becauſe it brings fluids into the gland. On the meſentery, the lacteals run but a very little way before they paſs into glands; not more than two or three inches in the ſmall inteſtines, and ſometimes not half an inch in the great inteſtines; but on the extremities, the vas inferens runs frequently two or three feet before it arrives at the gland to which it belongs.

A great number of vaſa inferentia often enter one gland. I have ſeen not only thoſe which run cutaneouſly, accompanying the vena ſaphena, but alſo thoſe which run deeper, accompanying the artery, enter the ſame gland.

The glands, I have ſaid, are of an oval ſhape. In their more common ſituation in the body, one end of the oval is turned towards the thoracic duct, and the other from it. The vaſa inferentia enter the gland by that end of the oval which is turned from the duct. When the vas inferens comes almoſt in contact with the gland, it ſplits, or reſolves itſelf into radiated branches, ſimilar to thoſe by which it originated. Theſe, like ſo many fingers as it were, lay hold of the gland, and ſink into its ſubſtance.

Mr. Hewſon had an idea that there were lymphatics which entered the thoracic duct, without having paſſed through any gland; and that the duct might be injected from the great toe, without one gland being filled in the whole courſe of the veſſels. I have injected the thoracic duct, from lymphatic veſſels on the back, without injecting any gland; but I do not believe that this is poſſible any where elſe. I confeſs, that I have injected lymphatic veſſels from the great toe, which ran along the lower extremity, and paſſed under Paupart's ligament, without having previouſly entered any gland; but if they did not enter the glands before, they always entered them at that place, or other glands in the courſe of the iliac veſſels; and if it ſo happened that they paſſed theſe, they always terminated in the lumbar glands before they entered the duct. The ſame thing is true of the lymphatics of the arm. One may inject veſſels from the thumb, which ſhall run along the whole extremity, without entering any gland, till they come to the clavicle; but it never happens that they terminate in the thoracic duct, or the right trunks of the lymphatics.

phatics, without having firſt paſſed through glands. Mr. Hewſon meant, by this obſervation, to ſhew that the body might be poiſoned by abſorption of the venereal virus in the lymphatics, without our having any previous information by a buboe; and it cannot be denied, that very often patients have been affected with lues venerea, who had no previous buboe. When this happens, it does not prove that the lymphatics carried the poiſon to the thoracic duct, without having previouſly paſſed through any gland; for though we know that the venereal virus muſt paſs from the buboe in the groin to the glands on the inſide of Paupart's ligament, yet there is hardly an inſtance of theſe glands inflaming and ſuppurating. Why the glands in the cavity of the abdomen do not inflame and ſuppurate on theſe occaſions, I do not know; but it is very fortunate they do not; for if they burſt into the cavity, ſuppuration of the cavity would be the conſequence, and the patient would almoſt certainly be cut off.

The vaſa inferentia frequently run under or cloſe to the ſide of other glands, before they terminate in their own glands, without having the ſmalleſt communication with thoſe glands.

The veſſel correſponding to the vaſa inferentia, and which goes out of the gland on the oppoſite ſide, anatomiſts have termed *vas efferens*, as carrying fluids out of the gland.

The vaſa inferentia are almoſt always more numerous than the correſponding veſſels going out of the gland. I have injected fourteen vaſa inferentia on the thigh, belonging to the ſame gland; and have no doubt of there being four times that number, belonging to the gland, which were not injected. To all of theſe, one vas efferens only correſponded, which went out of the gland on the oppoſite ſide. The vas efferens goes out of the gland in the ſame manner that a vas inferens enters it, that is, by ſhort, extremely minute, radiated beginnings. The vaſa efferentia are generally larger in ſize than the vaſa inferentia. I have ſeen ſome of theſe as large as the thoracic duct itſelf. They generally terminate ſoon in other glands; with reſpect to which they become vaſa inferentia. Anatomiſts ſpeak as if the ſame lymphatic veſſel might paſs through a great many glands, before it terminated in the trunk of the ſyſtem:—"Ad quintam uſque glandulam," ſays Haller, "eandem truncum lacteam quam mihi ſelegerem proſecutus ſum." Though the vas efferens correſponds to the vas inferens, it is a perfectly diſtinct veſſel, and the different glands are chained to one another by different veſſels. There needs no other proof

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of this, than the inſtance I have already given, of one vas efferens correſponding to fourteen or ſixteen, or more, vaſa inferentia. The nearer we come to the thoracic duct, the vaſa efferentia are larger. On this is founded the diſtinction of the lacteals into thoſe primi and ſecundi generis; theſe laſt being five or ſix times larger than the former. The vaſa efferentia are not always larger than the vaſa inferentia; and veſſels of the ſame ſize frequently connect ſeveral glands, one after another, together.

Anatomiſts have been, and ſtill are, divided in their opinions reſpecting the minute ſtructure of that part of the ſubſtance of the glands, with which the lymphatic veſſels are more immediately connected. One ſet contend, that the glands are principally made up of convolutions of the vaſa inferentia; whilſt others as ſtrenuouſly contend that they are a congeries of cells, totally diſtinct from the lymphatic veſſels. Arguments have been adduced on both ſides, from phyſiology, from the appearances in ſome diſeaſes of glands, as well as from anatomy. Thoſe who favour the opinion of the glands being a conglomeration of lymphatic veſſels, contend, that if the abſorbed fluids were once poured out into cells, they know of no power by which they could ever get out again. "Albinus argentum vivum minime in ſpatiola aliqua glanduloſæ fabricæ effundi monebat. In ea enim cavea ſi aliqua hujus liquoris in maſſulas & guttulas effuſio locum haberet, nulla porro vi credebat effectum iri ut in vaſa avehentia idem reſumeretur." This argument is taken from what happens in the dead body, and of courſe is not properly applicable to the living. If it proves any thing, it proves that Albinus was not dexterous in injecting lymphatic glands; and indeed Haller confeſſes as much; for he ſays, "Nulla vi fluidiſſimum metallum in lactea vaſa impulſum ad totam lacteam ſyſtema, aut in ductum thoracicum, urgere potuerim, neque magis ſucceſſiſſe vidi cum ſummus anatomicus Albinus id experimentum fecerit." We find at preſent very little difficulty in doing what Haller ſays they could not do ulla vi. Beſides, the fluids poured out into cells may be puſhed on by the vis a tergo, as the arterial blood in the cells of the placenta is puſhed on into the orifices of the veins; or, the fluids may be abſorbed from the cells of the gland by the orifices of the vas efferens, as eaſily as it was abſorbed at firſt by the orifices of the vas inferens.—The arguments deduced from the diſeaſed appearances in the glands are not more ſatisfactory, though

they are brought to prove the reverſe of the former. It has been urged, that the glands muſt be cellular; the uniform appearance in their diſeaſes ſhew it. They degenerate ſometimes into hydatids, or round veſicles; which may be eaſily accounted for, if we ſuppoſe cells obſtructed and enlarged in the gland. Stony concretions are ſometimes found in them, and theſe are almoſt always of a globular figure. Oſſifications are frequently found in them, and theſe are always externally tuberculated; a proof, ſay they, of their beginning in, and retaining as they encreaſed the figure of, the cells of the glands. In the ſcrophulous ſuppuration of theſe glands, the pus is found cheeſy and ſolid, in ſeparate, and generally round cavities; which is conceived to be a farther confirmation of cells, and of its having been formed in ſeparate cells. All of theſe appearances I have certainly ſeen; the firſt leſs frequently than any of the reſt. But the argument, though originating with Malpighi, is by no means a good one. The ſame appearances are found in the diſeaſes of other parts, where anatomiſts have not ſo much as ſuppoſed regular and uniform cells. In the ſkin, cellular membrane, amongſt the muſcles, in the teſticle, and many other parts, the ſame diſeaſes are found.—The next arguments are adduced from actual injections of theſe glands with quickſilver, and the appearances afterwards in the microſcope. The glands thus injected, dried, and made tranſparent, have been ſubjected to the microſcope; and one party of anatomiſts have ſeen, or ſuppoſed they ſaw, convoluted veſſels only; another, principally cells. As there are very great authorities on both ſides, I ſhall mention the principal ones, and then give my obſervations.

Albinus I have already mentioned, as ſupporting the doctrine, that the glands conſiſted of convoluted veſſels only. He allowed, indeed, the appearance of acini, but held them to be uninjected veſſels. "Albinus autem pro vaſorum glomerulis habuit in quæ liquor injectus non penetraſſet, hinc obſervavit multos videri acinos, quando omnia vaſa non repleta ſunt, paucos ſi repleveris." He was ſeconded in this doctrine by the firſt anatomiſts of his age. Haller ſays, "Demum accuratiſſimi inciſores Hunterus, Albinus, & Mekelius glandulas conglobati generis pro mero plexu vaſorum lymphaticorum aut lacteorum habent quæ celluloſo textui uniantur." Mr. Hewſon alſo joined that claſs. Dr. Hunter was certainly formerly of this opinion, but

but changed it for mine many years before he died. Profeſſor Mekel, ſays, ſpeaking of the lymphatic glands, " Glandula ejuſmodi microſcopio contemplata nihil niſi plexus vaſorum ex lymphatico vaſe ortorum apparet."

Mr. Hewſon, in his publication on the Abſorbent Syſtem, promiſes, in a future work, to give an account of the lymphatic and thymus glands. As death prevented him from fulfilling his promiſe, I collect what muſt have been his opinion of this matter, however, from a paſſage in his Experimental Enquiries, and from preparations of his injecting, which are ſtill in the collection in Windmill Street; in which, many years ago, he obſerved to me, no cells were to be ſeen. In the paſſage alluded to, he hints his being of the ſame opinion with Profeſſor Mekel; for he ſays, page 154, " The ſuppoſition of red veins opening into a lymphatic gland appears improbable, from an obſervation concerning the ſtructure of glands, for which we are indebted to Dr. Mekel, viz. that they are made of a convoluted veſſel." Nay, ſo far did he carry his idea of the ſimplicity of the abſorbent glands, that an abſorbent veſſel ſplitting into two, and inſtantly uniting again, was enough, according to him, to conſtitute a gland.

In oppoſition to theſe authorities, there are alſo ſome of the firſt anatomiſts.—Malpighi held, that the lymphatic glands were cellular, but in the ſame manner as other glands, that is, they conſiſted of acini. Haller ſays, " Marcellus Malpighius rotundos acinos, intus cavos in area fibrarum (cellulosæ nempe telæ) poſitos, plenos liquore pellucido cinereo in morbis vero tartareo & deſcripſit, & contra Nuckium non admittentem tuitus eſt." And again, " Et quidem in cavos ſuos acinos lympham utique effundi ſtatuit Malpighius, & experimentum addit, atramentum nempe injectum in loculis morboſæ glandulæ hepatis ſtagnaſſe."—Morgagni alſo defended this opinion of Malpighi's. Haller, in his life of Morgagni, ſays, on this ſubject, " Epiſtola tertia fere ad glandulas ſebaceas, & ad glandulas in univerſum pertinet quarum & viſcerum fabricam veſicularem contra Ruyſchium ſtudet confirmare & Malpighium tueri."—Nuck, though he did not admit Malpighi's acini, yet he maintained that the glands were cellular in another ſenſe; to wit, like moſs, or like the cellular membrane. Profeſſor Mekel, ſpeaking of this opinion, ſays, " Nuckius his glandulis ſubſtantiam

ſubſtantiam muſcoſam plane ſingularem ſpongioſam tribuerit." Ruyſch, I have already ſaid, admitted acini in the ſtructure of the lymphatic glands; but his acini belonged to the arteries, and not to the lymphatic veſſels; beſides, his acini were not like Malpighi's, hollow, but a globular ſubdiviſion of arteries into minute branches. Haller ſays, "Et ipſe Fredericus Ruyſchius acinos nonnullos glomerulorum ſimiles depinxit, verum caveos eſſe aut liquorem continere idem negavit."

Haller deſcribes the lymphatic glands, in one part of his work, as cellular, in the manner Nuck had deſcribed them, and admits their ſpongy texture, "ex fibris non cavis recte fieri Nuckius docuit." He there ſpeaks of their ſtructure as a very ſimple affair: "Fabrica mihi valde ſimplex viſa eſt, quam inſigniter complicatam & difficilem varii etiam bonæ notæ ſcriptores faciunt."

And accordingly, ſpeaking of the lymphatic glands of the meſentery and meſocolon, in one place he ſays, "Iterum ut vaſa lymphatica ad ſuas glandulas ita ad meſentericas lactea ſe habent. Quando enim ad glandulas utriuſve meſenterii pervenerunt unico trunculo, aut potius pluribus, dividuntur pariter in ramos, inque celluloſam naturam glandulæ ramos amittunt ramoſos tot & tantos, ut tota glandula in capellis etiam potiſſimum ampulla lacte plena videatur, neque facile ſit acum figere quin de vulnuſculo lac exſtillet." Here every thing ſeems clear and eaſy; but in the very ſame page he ſays, "Difficile eſt dictu, num in ejuſmodi glandula lactea vaſcula continuo maneant, num potius chylus in celluloſam telam deponatur, & ex ea per ductus efferentes iterum reſorbeatur—anatome hic nihil definit." And in another volume of his works, ſtill on the ſame ſubject, he ſays, "Verum omnino difficile eſt definitu, num lympha vaſculorum advehentium unice in revehentia reſumta tranſeat, num potius in aliquas glandularum caveas prius effundatur, ex quibus per revehentes ductus reſorbta exeat?"—And, having at laſt adduced the authorities on both ſides, for and againſt the cellular ſtructure of the glands, he then endeavours to reconcile them: "Neque impoſſibile videtur utramque ſententiam conciliare. Cum enim in omnibus glandulis conglobatis pariter in meſentericis juniorum animalium ſuccus ſeroſus etiam lacteolus ſed tenuior reperiatur, poterit fieri ut lactea quidem vaſa prima

cum ſecundis continuentur, ceterum arteriæ eum cremorem in glandularum celluloſa ſpatiola deponant, minimæ vero venæ reſorbentes eumdem reſumant, inque ſecunda lactea ſive in truncos efferentes revehant."—From what has been ſaid, it will appear, that it is no eaſy matter to unravel the ſtructure of the lymphatic glands. I ſhall faithfully relate what has occurred to me, having been very much occupied in injecting theſe glands with quickſilver. If the glands are compleatly injected with quickſilver, and then examined in the microſcope, it is certainly true, as Profeſſor Mekel has obſerved, that nothing but convolutions of lymphatic veſſels are to be ſeen in many inſtances; but it is as true, that after the moſt ſucceſsful injections of theſe glands, the cells have been ſeen perfectly diſtinct. I have injected many glands, where there was not the leaſt appearance of a convoluted veſſel, and where the radiated branches of the inferens and efferens, with intermediate cells only, were to be found; but I never injected a lymphatic gland, where I did not ſee ſome cells, particularly if I was attentive to the mercury juſt as it entered the gland. Accordingly, one of the beſt methods of ſhewing theſe cells, is ſtopping the injection after the gland is half filled; the cells are then exceedingly evident. But if the injection goes on, the cells are covered over with ramifications of finer veſſels, entering thoſe cells, and injected contrary to the valves. I have injected theſe into the ſurrounding cellular membrane itſelf, in the human ſubject. In quadrupeds it is very eaſy to demonſtrate the cellular ſtructure: both in aſſes and horſes the glands on the meſentery are moſt diſtinctly cellular, as will be ſeen in the annexed engravings. In the former, the cells are diſtinct, without any other diſſection or preparation of the glands than merely injection; but in horſes it is neceſſary to dry them, and afterwards lay them open; the cells then appear like thoſe of a honey-comb, and briſtles may be paſſed from one ſet into another, by lateral perforations, as is ſeen in the plates. When there is but one vas inferens and one efferens, there is but one ſet of cells; but when there are many, each appear to have their proper cells; and theſe cannot be injected from the other cells, but only by their own inferentia.

It has been alledged by ſome, that cutting into a lymphatic gland, and obſerving the appearance of cells, is no proof that it is actually ſo.

In

In this way the veſiculæ ſeminales appear cellular; and yet Haller proved, by maceration and diſſection of the cellular membrane only, that they could be drawn out into the form of ſmall inteſtines, or ſtraight tubes; and that it was convolution only, and connection of cellular membrane, which made them put on this appearance. Now, ſay they, may not the lymphatic glands appear cellular, and yet really be convolutions of veſſels? In the firſt place, it is not poſſible to do the ſame thing with theſe convolutions, ſuppoſing them to be ſuch, as Haller has done with the veſiculæ ſeminales. In the next place, though I allow that even in the lymphatic glands of the horſe, which are here exhibited engraved, there is ſomething of the appearance of a twiſted veſſel in the outſide view, yet it can never be ſuppoſed to be the entering veſſel which is thus convoluted, as its diameter is fifty times that of the radiated extremities of the inferens. Again, no convolution of veſſel only can ever account for the lateral communication of ſome cells, and there being no connection between others.

CHAP. XV.

The Ramifications, Anaſtomoſes, Number, and Size, of the Lymphatics and Lacteals.

THE common appearance of arteries and veins, is that of trees ſending off branches; and the term anatomiſts employ to expreſs this appearance, is *ramification*. The lymphatics ſend off their branches very much in the ſame manner as the arteries and veins, in moſt parts of the body; only their branches in ſome parts are vaſtly more numerous, and cloſer together, than thoſe of the blood-veſſels. This appearance is frequently to be met with on the external ſurface of the liver. On

the extremities they run in the form of long parallel tubes, apparently without ramifying; on more careful examination, however, I find that this is a deception; that they certainly do ramify, though not ſo much as on the liver; and the reaſon why they appear not to ramify is, that a pair of valves are almoſt always placed at the beginning of every branch, which hinders the injection from paſſing down. I formerly obſerved, that this appearance was to be found in the thoracic duct, the trunk of the ſyſtem itſelf. Lymphatic veſſels, however, frequently do run a long way without ramifying at all; ſometimes two or three feet, or more. This is different from any thing we find in arteries or veins. The carotids run ſix or eight inches ſometimes, and the iliacs nearly as much, without ramifying: but, except the arteries and veins of the umbilical cord, there is no other inſtance of the blood-veſſels running ſo far without branches. The lacteals form a deep-ſeated and a ſuperficial ſet; theſe laſt are very irregular in their courſe, and ſeldom appear to ramify; the former, in their mode of ramifying, are not to be diſtinguiſhed from the arteries and veins, and run exactly parallel to them. The larger lymphatics of the lungs have ſomething very peculiar in their appearance, and in general reſemble a fiſhing-net: the areolæ of this larger net-work are filled up with a finer and more intricate net-work of ſmaller lymphatics; ſo that the whole external ſurface of the lungs may, in a very ſucceſsful injection, be covered with lymphatics. In general, we only inject the coarſer net-work; the areolæ of which, lying in the interſtices ſurrounding the ſmall lobules of which the lungs are compoſed, are generally of a ſquare figure. This net-work was noticed by Haller; who expreſſes the appearance by the words "Vaſa concatenata reticulum facientia." In the lungs of the turtle, the lymphatics form a ſimilar net-work; but in the lungs of many quadrupeds they ramify, in the uſual manner of arteries and veins, without forming any net-work reſembling that now deſcribed. In the inteſtines of the turtle, there is alſo a very fine net-work of parallel veſſels, ſituated between the muſcular and villous coat. When this is injected with quickſilver, and the inteſtine fully inflated and dried, the mercury appears as if extravaſated into the cellular membrane, though more regular and uniform; but if, after having injected the net-work, the inteſtine is inflated only to one third of its diameter, the cylindric veſſels forming this net-work, and which

are every where of the ſame diameter, become extremely diſtinct. I believe that theſe veſſels communicate with one another, either by exceeding ſhort branches, or lateral foramina; for it fills immediately and uniformly, after the mercury has once entered it. A ſimilar net-work is to be found on the ſpleen in calves.

The branches of the arteries in the human body ſo unite with one another, that the arteries of almoſt the whole body may be injected from any one of the branches. This communication between the branches of the arteries is termed anaſtomoſis. The branches of the lymphatics and lacteals alſo anaſtomoſe; ſo that, did not their valves prevent retrograde motion, what was aſſerted of the arteries might be alſo aſſerted of them; that by a pipe introduced into any one of the branches, the greater part of the ſyſtem might be injected. This anaſtomoſis takes place not only between the ſmaller branches, but between the larger trunks and the glands themſelves. It is thence that very many lacteals and glands, and even the thoracic duct itſelf, may be filled from one lacteal on the inteſtine. From one lymphatic on the top of the foot, a conſiderable number of other lymphatics on the leg and thigh, the greater number of the glands in the groin, on the edge of the pelvis, on the vertebræ of the loins, and the thoracic duct itſelf, may in the ſame manner be injected. From one abſorbent on the external ſurface of the liver ſome hundred of the ſuperficial ſet may be filled, and a great number even of the deep-ſeated ones. It has ſometimes happened, that nearly half of the abſorbents of the lungs have, in the ſame manner, been injected from a ſingle aperture in any one of the lymphatics, on their external ſurface. Some years ago I diſcovered an anaſtomoſis between the lacteals coming from the meſentery, and the lymphatics of the liver and diaphragm; and, in conſequence of this communication, was able to demonſtrate, at lectures, the lymphatics on the upper ſurface of the diaphragm turgid with white chyle. In the inteſtine of the turtle, if the quickſilver can be made once to enter the net-work, all the lacteals of the inteſtines and meſentery may be injected from it; and on the lungs I have, from one veſſel, actually injected all the lymphatics of a whole lobe. The intention of nature, by theſe anaſtomoſes, is evidently to ſecure a number of roads, by which theſe important fluids, the chyle and lymph, may be carried into the blood. In the inſtance I have mentioned, of the anaſtomoſis

ſtomoſis between the lacteals and the lymphatics of the liver and diaphragm, the chyle, it is evident, may get into the blood, were the thoracic duct itſelf obliterated; for the lymphatics of the diaphragm paſs under the ſternum and cartilages of the ribs, to the angles between the jugulars and ſubclavians of both ſides.

Aſellius has repreſented the lacteals in quadrupeds as numerous on the meſentery as either the arteries or veins; and anatomiſts in general have allowed his repreſentation to be juſt. In the human inteſtine, thoſe which I call the deep-ſeated ſet, are exactly double the number of the arteries or veins; for every artery is attended with one vein and two lacteals: the artery and the vein lie in the middle, and the lacteals one on each ſide. In the inteſtines of the turtle, if the network is included, the number of the lacteals, in proportion to the arteries and veins, is ſtill greater; ſo very much ſo, that I am tempted to ſuſpect that they do ſomething elſe than abſorb chyle or lymph. Though the lacteals were allowed to be ſo numerous in many animals, anatomiſts in general did not believe that the lymphatics of other parts were in proportion numerous. I have already quoted Haller's ſentiments on this ſubject, declaring that the lymphatics were by no means, in point of number, to be compared with arteries, veins, or nerves; and a phyſiological writer has termed them a trifling appendage of the red veins. In my diſſections, I have found more lymphatics than either arteries or veins, in ſuch parts of the body where I have ſucceeded well in the injection; and I have no reaſon to doubt but they are as numerous in the other parts.

In the extremities of the human body, the ſuperficial lymphatics are vaſtly more numerous than the cutaneous veins, fourteen trunks frequently accompanying one cutaneous vein: and the deep-ſeated lymphatics are at leaſt double of the arteries they attend, every artery being commonly accompanied with two red veins and two lymphatics. On the omentum of the turtle, the lymphatics are more numerous than the arteries in the proportion of four to one; and ſuperior to the veins in the proportion of four to two; the arrangement being conſtantly thus: an artery lies in the middle, between two lymphatics; two red veins lie on each ſide of theſe laſt; and two other lymphatics on the outſide of the veins. I once injected the lymphatics of the ſkin by accident;

for the mercury ran contrary to the valves. The portion of ſkin thus injected was ſmall, but the lymphatics were very numerous in proportion; and, from what I then ſaw, I could have no doubt of the lymphatics being as numerous on the ſurface of the ſkin, as they appear on the ſurface of the inteſtines.

In the arterial ſyſtem, there is a certain proportion kept up between the trunk and the branches; any one of theſe laſt being ſmaller than the trunk, and the branches in general gradually diminiſhing in ſize, by branching afreſh, in proportion as they recede from the trunk. There is a good deal of this appearance even in the venous ſyſtem, though not ſo regular throughout; the right jugular, for example, being commonly twice the ſize of the cava ſuperior, its trunk, and the left jugular often twice the ſize of the left ſubclavian. But in the abſorbent ſyſtem, the diſproportion between the trunk and branches, in point of ſize, is exceedingly remarkable. I have ſeen one of the efferentia from a gland in the groin larger than any part of the thoracic duct, except its beginning and termination, where it is generally largeſt. I have ſeen the trunk of the lacteals equally large. One of the trunks of the lymphatics of the lungs, which I had injected with quickſilver, was twice the ſize of the duct, as it lay behind the root of the lungs, on the ſpine. Two of the trunks of the abſorbents, in the lungs of an ordinary-ſized turtle, were each of them as large in diameter as the cava ſuperior in the human ſubject, and ten times the ſize of the thoracic duct they belonged to, if the receptaculum chyli be excepted.

There is in the branches themſelves a peculiar appearance, connected with their ſize; this appearance ſometimes is to be found in the red veins; it is then the effect of diſeaſe, and we ſay they are varicoſe; but it is natural to the lymphatics, particularly in certain parts of the body, and in certain animals. The lymphatics of the legs, liver, and diaphragm, in the human ſubject, frequently put on this appearance. It is almoſt always to be found, and that in a very great degree, in the lymphatics of the ſpleen of a bullock. The veſſels appear large at one place, preſently contracted to one fourth of that ſize, and then ſuddenly dilated again; and thus alternately, like a chain of veſicles joined by very ſmall links.

CHAP.

CHAP. XVI.

The Termination of the Lacteals and Lymphatics.

WHAT follows, is to be conſidered as chiefly applicable to the human body. Some of the arguments will apply equally well to quadrupeds, and to the other claſſes of animals; but my principal object, from the beginning, has been the abſorbents of the human body: and now, that I am come to the termination of theſe veſſels, I wiſh to adhere more ſtrictly to this principal object. When anatomiſts ſpeak of the termination of lymphatics and lacteals, they are to be underſtood in a threefold acceptation. In the firſt place, they ſay, lymphatics or lacteals terminate in glands. In the ſecond place, they ſay, that they terminate in the thoracic duct, or in the ſecond trunk of the abſorbents, ſituated on the right ſubclavian vein; or, laſtly, they ſay, the ultimate termination of lacteals and lymphatics is in the ſubclavian and jugular veins. I have already minutely deſcribed the glands, as they appear to me more connected with the general hiſtory of theſe veſſels. I proceed now to give ſome account of the two great trunks of the abſorbents, reſerving the particular deſcription to the ſecond part of this treatiſe; as alſo to enquire into the reaſon why theſe trunks terminate at laſt in the veins, and in that particular part of the venous ſyſtem where they ſo uniformly terminate in all animals where they have yet been found, and particularly in men. Some of the cauſes which have been aſſigned for this ſtructure are only applicable to the human ſubject in its erect poſture; but the anatomiſts who have aſſigned theſe cauſes have forgot that a half, or at leaſt a third of our life, is ſpent in an horizontal poſture. Perhaps one of the uſes of ſleep, and of the horizontal poſture during that period, may be to facilitate the introduction of the chyle and lymph into the blood. However, as the human ſubject is more frequently in an erect poſture, the reaſons for the termination of this ſyſtem ſhall be conſidered in that point of view. I have already ſaid every thing that I thought neceſſary reſpecting the termination of lacteals and lymphatics in glands. The terminations

terminations of these vessels in the receptacle of the chyle, as engraved in the works of the most celebrated anatomists, are imaginary and false. The fact is, the thoracic duct has not yet been well delineated by any anatomist; they seem to have had no true conception of its extent; and very little, indeed, previous to Mr. Hewson, was known of the second trunk. The thoracic duct in the human subject is formed principally from three great vessels; one of these corresponds with the right leg, the other with the left, and the third with the lacteals of the small intestines. This duct is frequently one fourth of an inch in diameter at its beginning; it is sometimes about half that size in diameter near its termination; it is frequently not more than a tenth of an inch in diameter about its middle, at other times double or triple that size at the same place. It commences about the third vertebra of the loins, reckoning from above downwards; it there lies on the left side of the spine, under the aorta; afterwards it runs to the right of the superior vertebræ of the loins, and along the right side of all those of the back, except the four uppermost, where it passes to the left side; after which it emerges from the cavity of the chest; and, running about an inch or more above its destined termination, it forms an arch, and runs downwards, to enter the veins in the angle between the jugular and subclavian of the left side. There are valves found, in greater or lesser number, through its whole course; there are, particularly, a pair of valves at its termination in the angle mentioned. The thoracic duct in the human subject may be sixteen, eighteen, or twenty inches in length. The second trunk of the absorbents, or that which terminates in the jugular and subclavian of the right side, is frequently not more than a quarter of an inch in length; it lies upon the superior surface of the right subclavian, and terminates in the angle between it and the jugular of the same side; its diameter is not inferior to that of the thoracic duct, at the same place, on the opposite side. Why the lymphatics and lacteals terminate first in glands, I do not know. Why they terminate, after this, in two large trunks is very evident: in the first place, the larger the trunks are, the stronger are the muscular fibres; in the second place, the greater is the bulk of the fluids: in consequence of both these circumstances, the more certainly will the absorbed fluids overcome the resistance made to their entrance into the subclavian veins by the blood. Why they terminate at last in the jugular and subclavian veins is also very evident; for in the veins, the motion of the blood is slower, and the resistance, of course, less than it would have

been in the arteries. Why they terminate in the angles between the jugulars and ſubclavians, is alſo evident; for the reſiſtance of the blood to any fluid entering the veins muſt be leſs, as that blood comes nearer the heart. Why they enter at the angle is alſo evident; becauſe the columns of blood in the jugulars oppoſing thoſe of the ſubclavians with nearly equal force, the venous blood at this place muſt flow in the diagonal between the beginnings of theſe two veins, and the abſorbed fluids, of courſe, in the ſame direction as the current of blood in this place. The reaſon of the thoracic duct forming a curve, and deſcending to its termination, would ſeem to be to give its fluids the advantage of their gravity, by which they may more eaſily overcome the reſiſtance made to their entrance by the venous blood; but they would loſe more force from altering their direction, than they would gain by this addition from their gravity. The abſorbed fluids are not diſcharged into any other veins; and the reaſon of this is alſo evident; for, from their greater accumulation in the thoracic duct, their momentum is increaſed, and they are enabled more readily to overcome the reſiſtance from the venous blood. The reaſon alſo why they do not terminate nearer the heart, or in the cava ſuperior, is alſo evident; for then, every time the right auricle contracted, more reſiſtance would have been made to the entrance of the abſorbed fluids into the veins, as there is not only always more or leſs retardation of the blood's motion in the cava ſuperior, every time the right auricle contracts, but there is even retrograde motion, which is greater in proportion as the blood is nearer the auricle. Thus the thoracic duct, and the ſecond trunk of the lymphatics, are both inſerted with the greateſt poſſible advantages. This laſt argument, as well as that adduced for the termination of the lymphatics in the angle between the jugulars and ſubclavians, are thoſe employed by Dr. Fordyce. The reaſon alſo why the thoracic duct is inſerted into the left ſubclavian, in preference to the right, ſeems to be not merely that the former is nearer the duct, but becauſe the fluid coming from the left ſubclavian is not in ſo direct a line with the cava ſuperior as that from the right ſubclavian is; the retrograde motion in the blood, on the contraction of the auricle, will, of courſe, affect it leſs. That part of the left ſubclavian, lying under the ſternum, ſlopes gradually towards its inſertion into the cava ſuperior; and the abſorbed fluids, both in the erect and horizontal poſition of the body, from this circumſtance, deſcend, aſſiſted by their own gravity, into the heart. Morgagni employs a ſimilar argument for the termination of the thoracic duct as now deſcribed, and againſt the propriety of any other termination,

tion, viz. If the lymphatic veſſels had been inſerted into the cava inferior, they would have increaſed the quantity of fluids in that veſſel mounting upwards againſt their own gravity. This argument, he ſays, was firſt ſuggeſted to him, from Cowper's reaſoning on the propriety of nature's forming the vena azygos; which, he ſays, was in order to diminiſh the quantity of blood, which otherwiſe muſt have mounted upwards in the cava. Morgagni's words are, "Quam quidem ſententiam cum mihi ea primo cognita eſt, non parum fateor placuiſſe, ſive quod revera habeat cur placere debeat, ſive quod ſimiles ob cauſas ipſe olim conjeciſſem thoracicum quoque ductum, non in proximam venam cavam inferiorem, ſed in ramum ſuperioris influere."—Haller not only ſupports the propriety of the terminations as we have deſcribed them, but he combats the doctrine of thoſe anatomiſts who maintained other inſertions of lymphatics into red veins. Profeſſor Mekel, in particular, warmly contends for ſuch terminations: "Non raro mihi in repletione vaſorum lymphaticorum mercurii ope occurrit, liquidum hoc penetrabiliſſimum abſque extravaſatione ex vaſis lymphaticis in venas ſanguiferas tranſiiſſe. Hinc cavam venam inferiorem ex injectione in vaſa lymphatica mercurio plenam inveni—Inſertam in venæ portarum ramum gaſtricum lymphaticum vaſculum obſervaveram, cujus communicationis in Epiſtola mea de Vaſis Lymphaticis jam ante plures annos mentionem feci. Simili cauſæ repletionem venæ cavæ per vas lymphaticum incognitum mihi tribuebam."—Haller's reaſoning on this ſubject is ſo excellent, that I ſhall lay it before the reader in his own words: "Nullum teſtimonium, diſſimulavi, neque non moveor magno præcipuorum virorum conſenſu. Sed aliæ & ſatis graves rationes ſunt, quæ mihi hoc totum lymphaticarum venarum cum rubris commercium dubium reddunt & ſuſpectum. Expendi quam vicinas venas rubras lymphatica lumborum pelvis teſtiumque vaſa habeant, quam remotum inde ductus thoracici in venam ſubclaviam ſiniſtram patentis oſtium ſit, & exiſtimavi mirum omnino naturæ conſilium fore per immenſam longitudimem eam lympham ſurſum ducentis, ſi omnino non contrarium eſt ejus aut mori aut legibus in venas rubras lymphaticos ductus immittere. Sed etiam certo ſatis novi hepatis vaſa lymphatica adeo numeroſa, neque cavæ venæ neque illi immitti

quæ ad portas tendit. Ramorum etiam lymphaticorum certa fide ex omnibus corporis animalis partibus in truncos ſenſim majores, hinc in ductum thoracicum confluxus, manifeſtam inter eum ductum cavamque venam ſimilitudinem conſtituit. Porro ad naturæ conſtantem analogiam animum adhibui, quæ nuſquam minimas etiam rubras venulas in maximos truncos immittit, ſed in venas colligit ſenſim majores donec proximæ magnis ſuo lumine ſint in quas terminantur.—Iterum ductus chylifer proximam in abdomine venam cavam manifeſto præterit, & remotiſſimam ſubclaviam eo valde probabili conſilio petit, ut capiti, collo, artubus ſuperioribus propior accedat, earumque partium recipiendis lymphaticis venis ſe accommodet. Addidiſſe liceat, nunquam me vel unicum vaſculum reperiiſſe quod vera fide in venam rubram terminaretur, neque me abſque conſentientibus cl. viris eum vaſorum aquoſorum terminum rejicere. His omnibus penſitatis, valde mihi probabile fit omnem ex corpore humano redeuntem lympham prius in thoracicum ductum confluere quam ſanguinis maſſæ reddatur, ita et facilius in ſanguinis contrarium torrentem ſe ſua mole penetrat." —Great part of the reaſoning employed in pointing out the propriety of the inſertion of the thoracic duct, is applicable alſo to the propriety of the inſertion of the ſecond trunk of the lymphatics; though, at the time Morgagni and Haller wrote on this ſubject, it was leſs known. I have only to add, in confirmation of their doctrine, that I never ſaw a lymphatic veſſel inſerted into any other red veins than the ſubclavians or jugulars.

CHAP.

CHAP. XVII.

Concluſion of the Firſt Part.

HAVING examined the ſtructure and properties of the lacteals and lymphatics, I ſhall conclude with a review of their different functions; from whence their importance in the animal machine may be collected. The reader will have already anticipated me in many things, from what has gone before; but I wiſh here to bring the whole of their action into one point of view, which would not have been ſo well underſtood, if it had been attempted ſooner.

I have ſaid, that theſe veſſels carry fluids into the blood-veſſels, and there is no fluid in the body which they do not occaſionally carry into them; but thoſe which more peculiarly belong to them, are the chyle and lymph. It will be expected, that I ſhould ſay ſomething of the properties of theſe fluids, and of what importance it is to the animal machine that they ſhould be abſorbed and carried into the blood-veſſels.

In the firſt place, the chyle is the fluid into which our food is converted, in the ſtomach, duodenum, and, perhaps, in the jejunum and ilium; and which is afterwards abſorbed by the lacteals, and carried into the blood-veſſels. The importance of this fluid is obvious, as it is well known, that if the ſtomach is prevented from receiving food, and the chyle, of courſe, is not formed, nor abſorbed, the body waſtes, and the animal ſoon dies. On the contrary, when the ſtomach receives and digeſts the food properly, and the chyle is formed, and nothing prevents it from being abſorbed, the body is nouriſhed and ſupported. I am confident that this fluid cannot be formed any where elſe than in the ſtomach and duodenum, or ſmall inteſtines; and that it is the only fluid which can properly ſuſtain life in man, the mammalia, and birds. Glyſters of milk, broth, and what are commonly called nutritious fluids, may be detained in the rectum, may be abſorbed from it, and will ſupport the body for ſome little time, in caſes where no nouriſhment can be given by the mouth; as, for example, in ſtrictures and paralyſis of the œſophagus, exoſtoſis of the vertebræ of the neck, behind the pharynx, and in the locked-jaw; but I have not known any patient ſupported longer than three

three weeks by glyſters only, excepting in one inſtance, mentioned hereafter. Perhaps warm baths of ſuch fluids as are commonly uſed for our food would alſo ſupport the body for ſome little time; and Paracelſus is ſaid to have actually kept men alive for ſome days by this method: but the reaſon why they do not ſupport the body for any length of time is, that the rectum cannot convert theſe fluids into chyle; neither is there any property in the ſurface of the body which can produce this effect.

The chyle in men and quadrupeds is of a white colour; in birds and fiſhes it is tranſparent, and reſembles water. Taken from quadrupeds, it commonly taſtes ſalt, and has no ſenſible ſmell. Haller ſays that it is acid, by which means it corrects the tendency to putrefaction in the blood. His words are, "Utilitas chyli proxima eſt, putreſcibilem naturam ſanguinis acido ſucco ſuppeditato contemperare. Abſque chylo enim, ut oſtenſum eſt, omnes ſucci humani in ſummam acrimoniam tranſeunt, & febris accenditur, intra paucos dies funeſta." I never could perceive any marks of acidity in it; and the effects, that he attributes to the want of the acid of the chyle, are much better explained from the debility which want of food muſt produce in the body. The jail-fever, for example, attacks the ſtrongeſt perſons, and produces univerſal debility from the moment of its firſt attack; and, in conſequence of this, the ſtrongeſt ſymptoms of putrefaction of the fluids appear in a few days. Viewed in the microſcope, the chyle appears to contain globules, which are all of the ſame ſize; ſmaller, conſiderably, than thoſe of the blood, and reſembling the ſmalleſt globules found in cows milk. If the animal, from which the chyle is taken, happens to be in full vigor at the time, the chyle coagulates wholly in the veſſels into which it is received. If an animal in full vigor is killed at the time of the abſorption of the chyle from the inteſtines, the chyle will be found firmly coagulated in the lacteals. It coagulates in the ſame manner in the lacteals of the human ſubject; and it is in conſequence of this firm coagulation that I have been enabled to lay before the public the annexed engraving of the human lacteals and their orifices. In weaker animals, the chyle coagulates only in part, whether it is in the lacteals of the dead body, or received into a ſpoon from the lacteals of the living body. In this laſt inſtance I have found the craſſamentum floating on the ſurface of the uncoagulated part; a circumſtance in which it reſembles blood in a ſimilar ſituation. I have kept

chyle

chyle a great many hours, even two days, in the heat of ſummer, without its becoming putrid. Haller's account of the chyle is " Eſt in chylo lactis natura, color certe idem & gratus ſapor ſubſalſus—Levis eſt, ex oleoſa natura, cum aqua intrita & ſanguini innatat & ipſi ſero; fluidior tamen: ſed ipſe cremorem habet innatantem; facile ut lac cogitur—In eo chylo aqua eſt, & multa pinguitudo butyroſa, globulorum figura—Acida natura in chylo dominatur, ut ſibi permiſſus ſponte aceſcat, & aliquando in animalibus acidus fuerit ſapor—tamen is acor hactenus pinguedine obvolvitur ut ſuccum heliotropii nullo tingat rubore—Super ignem coctus chylus rubeſcit, & adfuſo vini ſpiritu, ipſe aut rubrum aut flavum colorem in chylo nunquam reperi—Non nigricat cum gallis; etiam quando ſal martis ſumptus eſt, naſcitur in inteſtinis intra duas, tres, quatuor, quinque, vel ſex horas." This fluid is abſorbed from the cavity of the ſmall inteſtines by the radiated extremities of the lacteals; is propelled through the lacteals by their muſcular coats for ſome little way; after which it is again depoſited, by another ſet of radiated extremities, into the cavities of the glands; from whence it is again abſorbed by the radiated extremities of other lacteals; and thus alternately, till, having been ſtrained through a vaſt number of ſmall tubes and cells, it is at laſt thrown into the thoracic duct, and by it is propelled into, and mixed with, the blood in the veins.

In the ſecond place, the lymph is the fluid ſuppoſed, by the firſt diſcoverers of the lymphatics, to be found only in them, and not in the lacteals, and which occaſioned their forming theſe veſſels into two claſſes. The truth is, the lacteals tranſmit chyle, when there is any chyle in the inteſtines; and at all other times either tranſmit lymph, &c. or are empty, and do not tranſmit any fluid.—The lymphatics commonly carry the lymph into the blood; but ſome of them may occaſionally alſo convey the chyle, as I have demonſtrated in the lymphatics of the diaphragm. Neither the lymph, then, nor the chyle are uniform fluids, but liable to conſiderable variation, and abſorbed only at particular times.

Haller, the moſt accurate of anatomiſts, ſays, " Et primum chylus per vaſa lactea movetur, & celeriter quidem. Nam vulgare eſt, jam alias citatum, ſpectaculum, chyli in vivi animalis lacteis vaſis conſpicui, qui paulo poſt evaneſcit omnis, ut vel lympha ſuccedat, vel inania vaſa nuda ſuperſint. Vidi etiam cæruleo colore tincta vaſa lactea perinde evaniſſe. Et viciſſim, cum in ciſterna lympha eſſet, lac in ejus locum ſucceſſit & in ductum thoracicum." And after-

wards, to the ſame purpoſe, he adds, " In ductu thoracico eadem phenomena vidi, & evaneſcentis chyli, & lymphæ, quæ poſt album chylum ſecuta eſt, aut alioquin inanem ductum replevit."

In the pureſt ſtate that I could procure the lymph, I found it poſſeſſed of the following properties. It reſembled water in fluidity, was tranſparent, ſometimes of a ſtraw-colour, or even brown; it alſo either coagulated wholly, on extravaſation, or coagulated in part, as the animal from which it was taken was either ſtronger or weaker. The ſame thing happened in the dead body, where it coagulated from reſt, or in conſequence of death. Mr. Hewſon ſays, that he has ſeen it coagulate round the edges of a wound received in the integuments, acroſs the middle of the tibia, in the human ſubject, where the cutaneous lymphatics ſituated there were accidentally divided, and which of courſe could not prevent their lymph from eſcaping at the wound. Haller mentions ſimilar wounds of the lymphatics from bleeding in the arm, where the flow of lymph was exceſſive, and could not be ſtopped but by the uſe of a great quantity of vitriol—" plurimo vitriolo impoſito." But he does not ſay that it coagulated on the ſurface of the ſkin.

Diemerbroeck ſays, in conſequence of experiments made on the lymph in living animals, " Lympham ex vaſis lymphaticis prope hepar aliiſve, in cochleari collectam, ab aere frigido in gelationem concreviſſe, & modo ſubflavum, modo alium colorem conquiſiviſſe, non ſemel obſervavimus." —In the lymph I obtained from quadrupeds I never could perceive any taſte or ſmell, nor any ſymptoms of putrefaction, after I had kept ſome of it for twenty-four hours, in the month of June. The lymph is now commonly ſuppoſed to be the fluid abſorbed from cavities and ſurfaces. Before we can ſhew the importance of its being abſorbed, I think it neceſſary to ſay ſomething of the ſtructure of theſe cavities and ſurfaces.

Anatomiſts uſe the term *cavity* in a different acceptation from other people. They ſpeak of the cavity of the ſcull, cavity of the thorax, and cavity of the abdomen, as if they contained air, or a conſiderable quantity of fluids. The truth is, they are compleatly full, by their ſurfaces being applied to each other, both in the living and even in the dead body. The term *internal ſurfaces* would have been better than cavities.—But, having ſaid ſo much by way of explanation, without altering the uſual language of anatomiſts, we ſhall give ſome general idea of theſe cavities.—Without including the cavities in the vaſcular ſyſtem, the cavities in the body

may

may be divided into thoſe which contain the viſcera, into the cavities of the uſually termed hollow viſcera themſelves, the cavities of joints, the cells of glands, and the cells of the cellular membrane.

There are ſome other cells, but I conſider them as appendages of the vaſcular ſyſtem; nor would I wiſh here to be underſtood as including the cells of bone. In the cavities containing the viſcera, viz. thoſe of the ſkull, thorax, and abdomen, the ſurfaces of the cavities themſelves, as well as of the contained viſcera, are large, and allow of a conſiderable extent of motion between each other, particularly the two laſt. Theſe have no communication with the ſurface of the body; and are every where imperforated, except by the mouths of the exhalent and abſorbent veſſels. The cavities of the hollow viſcera, on the contrary, open upon the ſurface of the body: as the ſtomach and inteſtines, urinary bladder, and the uterus and vagina in women. Their ſurfaces alſo are conſtantly moving upon one another. The cavities of the joints have a greater quantity of friction and motion between their ſurfaces than either of the former. There is no great friction or motion in the cells of glands, but there is certainly ſome; and the cellular membrane, compoſed in ſome parts of the body of exceeding broad laminæ, and in others of exceeding ſmall, admits of a great variety of friction and motion. Theſe ſurfaces are all moiſt; and though we have ſaid that, ſtrictly ſpeaking, the term cavity ſhould not have been employed, yet ſo far anatomiſts may be juſtified, that, although the ſurfaces of theſe cavities are generally applied to each other, they are all capable of being dilated, and of occaſionally containing more. The arteries, or perhaps certain other veſſels ariſing from them, and known commonly by the name of exhalents, are conſtantly throwing out a fluid into all the cavities of the body; this fluid keeps the ſurfaces moiſt, and makes motion eaſy, by allowing them to ſlide eaſily upon one another. This fluid, however, would accumulate in ſuch quantity, as to produce dropſy of all thoſe cavities, if the lymphatics were not conſtantly abſorbing it: now, though this alone is a very important function, nay abſolutely neceſſary to the continuance of the animal machine, I ſuſpect that the lymph is a fluid more extenſively uſeful, and that this is not all that is meant by making the lymphatics take it up. I ſuſpect that the fluid found in the lymphatics is, in part, the coagulable lymph of the blood; the fluid on ſurfaces never appeared to

me to have that property which the lymph has, of coagulating from extravaſation, or from reſt in the dead body. Mr. Hewſon's experiments, by which he believed that he had proved, that the fluid on ſurfaces, and the fluid in the lymphatic veſſels, were the ſame, never ſucceeded with me. He uſed to ſcrape, with a wet ſpoon, the ſurface of the peritonæum or pleura, till he had collected ſome conſiderable quantity of fluid: on letting it ſtand, he found that ſoon after it coagulated; and he conſidered this as ſtrong a proof of the lymphatics abſorbing from ſurfaces, as the chyle's being white and coagulating in the inteſtines, and being of the ſame colour, and having that property, in the lacteals, was a proof of their abſorbing it from the inteſtines. This experiment is liable to deception. In ſcraping theſe ſurfaces, veſſels, containing a coagulating fluid, may be torn, and it may not be the fluid of ſurfaces which is thus collected: beſides, the liquor of the pericardium, and of the ventricles of the brain, and of the tunica vaginalis teſtis, which are analogous fluids, never coagulated, in any of my experiments, under a leſs heat than that of 140 or 160 of Farenheit's thermometer; beſides, the quantity of lymph in the lymphatic veſſels is greater than we could ſuppoſe it to be, were it only the fluid of ſurfaces. Whether, therefore, they abſorb it from the cavities of the blood-veſſels, as from ſurfaces in common, or whether they ariſe alſo from the extremities of arteries, as Bartholin aſſerted, I do not know: I am rather diſpoſed to think the lymphatic vaſa vaſorum may take the coagulable lymph from the cavities of the blood-veſſels, for ſome purpoſe yet unknown.

I am alſo diſpoſed to think, that the vis a tergo, in the primary lacteals and lymphatics, propel the fluids depoſited in the cells of the glands, through their cells; for the extremities of the vaſa efferentia are connected only with thoſe ends of the glands which are oppoſite to the inferentia; and the ſucceeding fluids muſt either come in contact with the abſorbing orifices of the vaſa efferentia, in conſequence of the vacua they form by removing the fluids in contact with thoſe orifices, or ſome vis a tergo muſt propel them. One of the moſt eminent phyſiologiſts in London is diſpoſed to think that the vis a tergo is loſt, by throwing the abſorbed fluids into the cells of the glands; and that, in order that the vis a tergo ſhould have any effect in propelling the fluids through theſe cells, it is neceſſary they ſhould be tenſe, which

which he believes is not the caſe: it may, however, be otherwiſe. If it is not ſo, there is apparently a great loſs of power; and the abſorbents from the cells of glands are obliged to begin to abſorb from the cells, in the ſame manner that the primary abſorbents did from ſurfaces, without any advantage from the vis a tergo in the fluids of the vaſa inferentia. But abſorption from cells in glands may be as eaſy as from the firſt ſurfaces, and nature may be able to diſpenſe with this apparent loſs of power: or it may be as Bartholin ſuſpected, the lymphatics may alſo ariſe from the extremities of arteries; and the power loſt by throwing the abſorbed fluids into the cells of glands may be compenſated by ſome impulſe given to the chyle and lymph, in the lacteals and lymphatics, from the fluid of arteries, though I ſuſpect it is not ſo. Beſides the fluid which moiſtens the cavities of the hollow viſcera in common with all other cavities, there are great quantities of other fluids poured into them: the drink poured into the ſtomach may be two pounds in twenty-four hours; the ſaliva ſwallowed may be one pound in the ſame period, the gaſtric juice another, the pancreatic juice another. The bile poured into the inteſtines Haller ſuppoſes about twenty ounces, beſides the fluid ſecreted through the whole of the internal ſurfaces of the inteſtines. The urine bears ſome proportion to our drink; but the fæces are in a ſmall proportion to our food, the chyle, and to theſe fluids. Boerhaave ſuppoſes that all the ſecreted fluids, except thoſe of the kidnies and ſkin, are returned to the blood by the abſorbents. A very great part, I believe, is returned, but changed into lymph. Dr. Fordyce believes that a living body has a power of deſtroying animal and vegetable matter, and converting it into water, in a manner not yet underſtood. Perſpiration may then carry it off.—But the proper diſcuſſion of this ſubject would require a volume of itſelf.

In the third place, there cannot be a doubt but that the lymphatics abſorb on the ſurface of the body, and on an analogous ſurface, the internal ſurface of the trachea, and air-cells of the lungs. Eraſiſtratus taught that the arteries abſorbed air: and Galen ſays that the veins abſorb, εκ ολιγαν μοιραν περιεχομενω ημας αερω.—And ſays, that this was what Hippocrates alluded to in part, when he ſaid, "Εκπνοον και εισπνοον ολον το σωμα."—Dr. Hales found, in diſtilling blood, that a thirty-third part of the whole was true air. Haller, alluding to thoſe experiments, ſays, "Utique fere trigeſima tertia pars totius ſanguinis

verus eſt aer."—Whatever happens from diſtillation of blood out of the body, I am perfectly certain, that there are no looſe maſſes of air in the blood. I have tied up the trunks both of arteries and veins, when they were turgid with blood, in the living animal; on opening them under water, not a particle of air ſhewed itſelf. I even tied up the cava ſuperior, and the inferior, as far as the diaphragm; and, removing them with the heart and lungs entire, I placed them in the receiver of an air-pump, and exhauſted it; but neither theſe veins, nor the right auricle and ventricle, did ſwell, nor ſhew any ſymptoms of containing air.—The Chevalier Roza, in Italy, has endeavoured to confirm the opinion of Eraſiſtratus by experiments, by tying up the trunks of arteries when they appeared to be turgid with blood. On opening theſe arteries, an elaſtic vapour, he ſays, eſcaped, and they contained but very little real blood. I have ſeen nothing like this. Haller, ſpeaking of the air of the blood, ſays, "Ita in reliquo humore diſſolutus, ut nulla ejus bulla adpareat." And experiments made on the blood, in the air-pump, by others, rather confirm mine. "Valde ſpumat in ſpatio inani urina & ſuccus amnii; in albumine multus eſt aer; ex ſanguine difficulter prodit Muſſchenbroeckio teſte."

As to Galen's and Hippocrates's doctrine, that the veins abſorb air from the atmoſphere, I have proved that they do not abſorb any thing.

That air enters the blood-veſſels of the lungs, and combines with the blood, is probable, from the change of colour it puts on as it paſſes through the lungs during reſpiration. How this is effected, I do not know. It is alſo probable, that the lymphatics of the ſkin take in ſomething from the atmoſphere. Profeſſor Home found himſelf heavier in the morning than he was juſt before he went to bed in the preceding evening, though he had been perſpiring all night, and had received nothing, either by the mouth, or in any other ſenſible way. The Abbé Fontana alſo informed me, that walking ſome hours in the open and damp air, immediately after the operation of a purgative, that on returning home, and weighing himſelf again, he was ſome ounces heavier; a circumſtance which cannot ſo eaſily otherwiſe be accounted for, than by ſuppoſing an inhalation from the atmoſphere. The celebrated De Haen, finding that his dropſical patients filled equally faſt, whether they were permitted to drink liquids or not, did not heſitate to aſſert, that they *muſt*

abſorb from the atmoſphere. That the ſurface of the ſkin abſorbs other fluids, which come in contact with it, I have not the leaſt doubt. A patient of mine, with a ſtricture in the œſophagus, received nothing, either ſolid or liquid, into the ſtomach, for two months; he was exceedingly thirſty, and complained of making no water. I ordered him the warm bath, for an hour, evening and morning, for a month; his thirſt vaniſhed, and he made water in the ſame manner as when he uſed to drink by the mouth; and the fluid deſcended readily into the ſtomach.

In the fourth place, theſe fluids are not only abſorbed by theſe veſſels, but we have the ſtrongeſt reaſons for believing that the ſolid parts of the body are alſo, on a variety of occaſions, removed by them; an opinion, I believe, firſt advanced by Mr. Hunter. That the ſolids are removed, appears from the following facts. In young animals, the cavities of the cylindric bones enlarge as the bone enlarges, ſo that that cavity which was at firſt not ſo large as the cavity of a crow-quill, will afterwards receive one's finger, particularly in quadrupeds, bearing always the ſame proportion to the bulk of the bone; but this could not take place unleſs there was a power taking from the inſide in proportion to the addition that was made on the outſide. The ſame thing muſt take place in the cavity of the ſkull, which enlarges as the brain enlarges. It is not only in growing bodies that we obſerve this removal of the ſolids; we perceive it again in old age: there is then not only a general ſhrinking and waſting of the whole body, but, in particular, the alveolar proceſſes are removed; the noſe, for this reaſon, comes nearer the chin; there is a redundancy of the lips, and the tongue, in conſequence of the cavity of the mouth having been ſo much diminiſhed, and the ſpeech, for theſe reaſons, becomes indiſtinct. There are alſo other inſtances of the removal of ſolids in old people, that come leſs under common obſervation. The bones have then loſt one fourth of their former weight, at leaſt; a great part, therefore, of their ſubſtance muſt have been removed. That ſolids formed from diſeaſe are frequently removed, every body muſt have obſerved. A venereal node, for example, forms on the tibia, ſwells to a conſiderable ſize, and afterwards, from the uſe of mercury, diſappears entirely. A teſticle or a breaſt enlarges to double or quadruple the natural ſize, continues in this ſtate for years, and afterwards returns to the natural ſize. Ulceration takes place on the breaſt of a woman, and

ſpreading

ſpreading deſtroys it entirely, and in this way almoſt any part may be removed. The ſolids, then, are either conſtantly changing, or occaſionally removed. Now if the lymphatics and lacteals remove fluids, it is extremely probable that they remove the ſolids alſo, and that they not only bring in nutritious matter into the body, but have an equal ſhare with the arteries in the diſpoſing of it at laſt, and by that means co-operate with the arteries in giving ſhape to the ſolids in growing bodies. They alſo in a manner take down the body in old age. They are the principal agents both in the cure and removal of diſeaſed ſolids. How thoſe veſſels remove ſolids is difficult to ſay. It is not eaſy to account for their mode of abſorbing fluids: I ſuppoſe this laſt performed in the following way:—The liquid to be abſorbed affects the mouth of the abſorbent, and determines it to give it admiſſion or not. If it gives it admiſſion, the firſt part of the lymphatic abſorbs it, perhaps, as has been ſuppoſed, by its action, as a capillary tube. This fluid having entered, and filled the firſt part of the abſorbent, now ſtimulates its internal cavity, which again contracting, propels the fluid towards the trunks of the ſyſtem, as the valves do not permit it to relapſe into the cavity from whence it was abſorbed. Having propelled the fluid it laſt abſorbed, the mouth of the veſſel relaxes again, becomes empty, and a freſh quantity is taken in, as long as any fluid preſents itſelf. It is not certain that abſorption of fluids does not begin, in the extremities of veſſels, on the principle of capillary attraction only: this was the opinion of Aggiunti. But there is ſomething in the action of the abſorbing orifices which reſembles ſelection; nor is the abſorption ſo conſtant or uniform as capillary attraction muſt neceſſarily be. If the end of an empty capillary tube is immerſed in a fluid, the fluid muſt riſe in it, if it meets with no obſtruction; but the extremities of the lacteals are often immerſed in chyle without taking up any of it, as I ſaw in the orifices of the lacteals on the inteſtines; for ſome of the villi were loaded with chyle, whilſt others almoſt in contact with them were entirely empty. Boerhaave ſays, that the abſorbed fluids ruſh into the lacteals and lymphatics; becauſe the thoracic duct, contracting on its contents, is conſtantly forming vacuums; and that the velocity with which air ruſhes into the exhauſted receiver of an air-pump, is twice that of the ſwifteſt wind, or forty-four feet in a ſecond, as he had proved. This I doubt. —If the abſorption of fluids is difficult to be explained, much more ſo is the abſorption of ſolids. Mr. Hunter ſuppoſes that the abſorbents

ſorbents take down ſolids by a kind of reverſe action to that of the arteries in forming them. He does not pretend to know how this is actually performed; but it is not more difficult to conceive abſorbents removing bone, than to conceive that the arteries form it, which he ſays they certainly do. He ſuppoſes they may have a power ſimilar to that of a caterpillar eating up the leaf of a tree; and believes that the abſorbents elongate themſelves, or ſhorten themſelves, as their object recedes or approaches nearer. He even believes that the abſorbing veſſels of ſurrounding living parts are capable of elongating themſelves, and of abſorbing dead bone, which we ſee ſometimes partially and ſometimes wholly removed. We know that the lymphatics certainly take up ſolid particles; there can hardly be a doubt of their abſorbing the powder of calomel from the ſurface of the body, and that they carry it into the blood-veſſels. The globules of quickſilver, in the beſt prepared mercurial ointment, are never ſo ſmall but that they may be diſtinctly ſeen in the microſcope; and yet we know that they are abſorbed.

It is poſſible that, previous to the abſorption of a ſolid, the parts immediately to be abſorbed may be converted into fluids; we know of one menſtruum in the body, which is actually capable of converting a ſolid into a fluid, I mean the gaſtric juice, which converts various ſolids into one conſtant and uniform fluid, the chyle. The arteries may ſecrete a fluid on the ſurfaces of bones, on particular occaſions, capable of doing the ſame thing; or there may be alſo a fermentation, peculiar to the ſolids of a living body under certain circumſtances, by which they may be decompoſed and converted into fluids, retaining all the elementary particles of the ſolids. Mr. Hunter allows a decompoſing principle in the ſubſtance of teeth; and, ſpeaking of their decay, ariſing from rottenneſs, ſays, "This is owing to the "enamel loſing its regular and cryſtalliſed texture, and being reduced "to a ſtate of powder, from the attraction of coheſion being deſtroyed." Fermentation has been obſerved chiefly in dead matter, and is commonly accompanied with ebullition and extrication of air; but fermentation may alſo take place, and I believe certainly does take place, in living matter. Ebullition, or any evident motion, is not neceſſary to conſtitute fermentation; after wine has undergone what is called its open fermentation, it continues,

continues, after it is bottled, to go through its ſecret fermentation, where no motion is evident, and, every body knows, requires time to ripen. All that is neceſſary in fermentation is, that the elementary particles be ſeparated and recombined, ſo that the matter be converted into ſomething different from what it was before. There are ſome facts which diſpoſe me to believe that the firſt ſtep in the removal of ſolids is not owing to the action of lymphatics or lacteals; I have obſerved, in internal exfoliations of cylindric bones, where a very large portion of the old bone had died throughout, that the cancelli were deſtroyed, and that the bone muſt have been thinned as much upon the inſide as it was upon the outſide; nearly the whole length of the tibia was in this way reduced to a tube whoſe ſides were not thicker than a wafer, and reſembled portions of cylindric bones which had been expoſed for ſome time to the action of the gaſtric juice in the ſtomach of a leopard; ſome of which I have preſerved, in the ſtate I found them. As almoſt the whole bone died at the ſame time, which was evident by the lines of ſeparation at the two extremities, without any intermediate ſimilar lines, and which we conſtantly find on ſuch occaſions, whatever change after took place in its centre and inner ſurface, could not be owing to the action of veſſels. It may be objected, that it is impoſſible to diſcover what has happened in a diſeaſed bone, but by ſawing it open, maceration in water, drying, &c.; and we can never be certain what was the effect of their operation, and what actually took place while it remained in the living body. This is not true. There are opportunities of ſeeing what has happened to diſeaſed bones, without any of theſe proceſſes. I have ſeen appearances, ſimilar to what I have here deſcribed, taking place in the living body after the operation of the trepan, or in other caſes where a whole parietal bone had been killed, and left to ſeparate by the powers of the body.

I have frequently obſerved, that the ſhedding teeth of horſes waſted for an inch or two in length, after their connection with their own veſſels were broken off, and that this waſting had taken place though the teeth muſt have been all the while lying on the upper ſurfaces of the ſucceeding teeth, which we know are not at that place vaſcular. In the proceſs of exfoliation, when the living bone ſeparates from the dead, it is the living bone which is removed, at the place where it is in contact with the dead bone; no alteration whatever takes place

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in the dead bone, but it drops off as it were in conſequence of the living bone's retiring from it: but this fermentation, by which a ſolid is converted into a fluid, may, in a greater degree, depend upon the living principle, and may therefore take place more readily in the living than it does in the dead bone; which is juſt the reverſe of the fermentation that takes place to deſtroy dead animal matter in general. Dead animal matter, and dead vegetable matter, in general, go quickly into this fermentation; dead bone requires a long period before it is decompoſed, but is at laſt converted into a powder. The oil in the cells of dead bones appears to undergo a fermentation, by which it is converted into a white powder, which ſhews no other ſymptoms of its having been originally oil, than that ſome part of it ſtill liquefies when placed on a red-hot iron. But in whatever way the lymphatics and lacteals remove ſolids, it is, in the point of view we are now conſidering it, of the utmoſt importance to the conſtitution. The ſolids of the human body are not ductile, as has been imagined; nor malleable, as ſome metals; and they acquire their ſhape from the arteries depoſiting matter on one ſide, and the abſorbents taking it from the other. It is alſo of the utmoſt conſequence to the animal machine, that the living ſolids ſhould be removed from the dead, as in the proceſs of ſloughing, by which the ſofter living ſolids are removed from the dead, and in the proceſs of exfoliation, by which the parts of living bone are alſo ſeparated from the dead. There is another abſorption of theſe ſolids, but as it is a morbid proceſs, it will be conſidered by itſelf preſently.

In the fifth place, the lacteals and the lymphatics introduce medicines into the blood-veſſels, and by this means prevent as well as cure diſeaſes. —There are ſome medicines which appear to produce their effect by acting on the nerves of the ſkin or ſtomach before they could be abſorbed or carried into the blood-veſſels. Opium, for example, ſometimes almoſt inſtantly relieves pain, and wine and volatile alkali as quickly ſometimes take off debility. The Peruvian bark has been vomited up in ſolid maſſes after it had cured the intermittent for which it was exhibited. There are other medicines which produce their effect by ſympathy, in a manner hitherto inexplicable, and ſome applications produce their effect by counter-irritation. Thus, a bliſter applied to the head, or between the ſhoul-

ders, on the firſt attack of a fever, has preſently carried it off. But in order to prevent or to cure diſeaſes, it is often abſolutely neceſſary that the remedies be introduced into the blood-veſſels. Mercury lying upon the ſurface of the ſkin, or paſſing over the ſurfaces of the ſtomach and inteſtines, without being abſorbed, would never cure the venereal diſeaſe; nor do the venereal ſymptoms give way, till thoſe of mercury being in the conſtitution ſhew themſelves. It has even been aſſerted, that the mercury has afterwards been found in the cells of bones themſelves: Mead ſays ſo, on the authority of Braſſavalus, and Boyle, &c. I never ſaw this. Rhubarb not only affects the internal ſurface of the inteſtines, and purges, but is alſo abſorbed by the lacteals, carried into the blood-veſſels, and, paſſing off with the urine in the kidneys, imparts to it the yellow colour which every body muſt have obſerved in that fluid, after taking rhubarb. It was in conſequence of this obſervation that Haller exhibited rhubarb in ſmall doſes in the diabetes, expecting from its aſtringency, that it would contract the arteries of the kidneys, which he ſuppoſed either to be too much relaxed, or uncommonly dilated. Many medicines appear to be abſorbed and carried into the blood-veſſels without being altered as to their original properties: thus purging medicines, or even mercurial preparations, exhibited to nurſes, appear to have been abſorbed, carried into the blood-veſſels, and ſecreted with the milk by the arteries in the breaſt, and in this way have ſometimes produced ſimilar effects upon the children which they have ſuckled, as they did on themſelves. The colouring particles of madder, a medicine now exhibited frequently with ſucceſs in the ſuppreſſion of the menſes in women, not only affect ſome of the ſecretions, but impart a red colour to the growing bones of young animals; and turpentine, given by the mouth, ſome time after may be diſcovered by the ſmell in the urine. We cannot ſo well, on any other principle than that of abſorption and after depoſition, account for the inflammation which takes place in the neck of the bladder, and produces ſuppreſſion of urine, when the tincture of cantharides has been exhibited by the mouth. The tincture remaining unaltered in the abſorbents or blood-veſſels, and its being afterwards ſecreted by the arteries of the kidnies, and carried with the urine to the bladder, ſolves the phenomenon, as it produces a degree of the ſame effects there which it produces on the ſkin.

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In the last place, the lacteals and lymphatics become the causes of the most fatal diseases which attack the human body: this also puts these vessels in a very important point of view. These diseases may be divided into the following classes: In the first place, such as arise from these vessels not absorbing the healthy and sound fluids and solids of the body; secondly, such as arise from their absorbing too much of the healthy and apparently sound fluids and solids of the body; thirdly, such as arise from absorbing morbid fluids generated in the body; fourthly, such as arise from absorbing the diseased solids of the body; fifthly, such as arise from their absorbing irritating substances not generated in the human body, the infectious matter of diseases from other persons, and poisons, animal, vegetable, and mineral, from whatever quarter.

In the first place, it is possible that the lacteals may not always absorb the chyle after it is formed, and the patient may be cut off from that cause.—I have already given my opinion respecting Ruysch's doctrine, that in old age he lived without his lacteals, and that old people in general did so. I think it impossible; but Morgagni and Dr. Hunter himself inclined to that side, at least so far as respects the obliteration of the glands of the mesentery. The lacteals are never obliterated; there are no other roads by which chyle can get into the blood, as Haller allows there may possibly be; and the red veins of the intestines do not absorb.

It is possible that children, and even grown persons, may sometimes have died of the tabes mesenterica, a disease in which the glands of the mesentery belonging to the lacteals are supposed to be totally obstructed and impervious to the chyle. In such enlargements of the glands, if they ever take place, we should meet with the stagnation of the chyle in the first set of lacteals; but I never saw such stagnation on any occasion whatever: but, as stagnation of the lymph, from obstructed lymphatic glands of other parts, is said to have been seen, it may be possible that the chyle, from the causes mentioned, may have sometimes been prevented from getting into the blood-vessels.

The lymphatics sometimes have their orifices immersed in fluids, without taking up any sensible part of them; possibly the lacteals may sometimes be in a similar situation.

When the lymph is not absorbed from cavities, or not in the usual proportion to the quantity secreted by arteries, dropsy of these cavities

muſt be the inevitable conſequence, as there is no tranſudation in living bodies, nor any other openings than the mouths of the lymphatics and the exhalent orifices of the arteries, which cannot abſorb.—Dropſies appear to me to be of three kinds. The firſt is, where there is a general debility in the body: this is felt moſt in the lower extremities or legs; the extremities of the arteries are ſo relaxed, that they permit the thinner fluids to eſcape into the cavities of the cellular membrane, whilſt the lymphatic veſſels, having loſt their tone, do not take up theſe fluids. Caſes of this kind are frequently met with in young people from temporary debility, who have undergone ſome tedious and dangerous diſeaſe, as after fever. From this they frequently recover; but it is a very bad ſymptom in old age, accompanied with aſthma, as it is moſt probable that the viſible dropſy of the legs is then accompanied with an inviſible one, or water in the cheſt. Women frequently bear this ſwelling of the legs longer than men, even for years, without any danger. Some men have ſuſtained it for twelve years, without the leaſt decreaſe of their general health. I have ſeen the integuments of the ankles hanging over the ſhoes for months, and yet the patient has perfectly recovered.

The ſecond ſpecies of dropſy is very common, and is that which ariſes in conſequence of previous inflammation of a cavity; and may take place in any habit of body. If an inflammation ariſe in a cavity, it may terminate in a number of different ways: one of theſe ways is by an increaſed ſecretion of the fluid of ſurfaces.

A man receives a blow on the teſticle; inflammation takes place, and the conſequence is frequently a hydrocele, or dropſy of the tunica vaginalis. A child's brain inflames, and this inflammation ends at laſt in hydrocephalus, or collection of water in the brain. Pleuriſy frequently terminates in hydrothorax, or collection of water in the cheſt. I have often taken away forty or ſixty pints of water, which had accumulated in the cavity of the abdomen, in the few days the peritoneal inflammation had laſted, during the uſual ſpecies of the child-bed fever. This is to be conſidered as the ſubſtituting a leſs dangerous diſeaſe for another. Peritoneal inflammation kills often in three days, but aſcites may laſt twenty years.

When the arteries of the part have once got a habit of increaſing their ſecretions, they commonly go on for a long time. The lymphatics

phatics may, in ſome caſes, abſorb their uſual quantity of the fluid of ſurfaces; but, as the fluid ſecreted by the arteries often far exceeds the quantity which they abſorb, the dropſy is ſtill kept up; or, the lymphatics may be ſo altered by the inflammation, as not to abſorb a ſufficient quantity.

The third ſpecies of dropſy is that which ariſes from ſome obſtruction to the return of the venous blood to the heart. This may happen from the blood of the vena portarum being obſtructed in its courſe to the heart by a ſchirrous liver; and aſcites, or dropſy of the abdomen, may be the conſequence. It may happen from inflammatory adheſions of the ſubſtance of the lungs retarding the paſſage of the blood of the pulmonary artery through that viſcus. In either caſe, the venous blood is obſtructed in its paſſage to the heart; the arteries find a greater reſiſtance to their throwing their blood into the veins, and are obliged to relieve themſelves by an increaſed ſecretion from their exhalents, and thus moſt probably dropſy is produced in the cavities to which they belong; for when the obſtruction is removed, the dropſy diſappears.—I remember a caſe which I attended ſome years ago:—The patient had dropſical ſwellings of his legs, at the ſame time had a hoarſeneſs which had laſted for two years. One morning, in ſtooping to buckle his ſhoes, he burſt a blood-veſſel in his lungs, and from this accident loſt about two pounds of blood; both the hoarſeneſs and the ſwelling of the legs gradually went off, and he continued well for two years after.

Dropſies may deſtroy in a number of different ways.—The terror of the mind may combine with the debility of the body, in the firſt ſpecies of dropſy, and the patient may be cut off from this cauſe. In œdema of the limbs, the cuticle frequently ruptures at laſt, and inflammation of the cutis underneath is commonly the conſequence. Whether inflammation takes place from this cauſe, or whether it takes place in conſequence of ſcarifications, either mortification takes place, which is commonly fatal, or the inflammation, without any mortification, is in this habit of body accompanied with ſuch irritation as to deſtroy. The hydrocephalus kills by the too great preſſure it makes on the ſubſtance of the brain. The hydrothorax kills by compreſſing the ſubſtance of the lungs in ſuch a manner as to prevent reſpiration at laſt. If the

the aſcites does not kill by increaſing the general debility of the body, preventing ſleep, digeſtion of the food, and exerciſe, and in a great meaſure impeding the action of the lungs; the operation which is performed to relieve the patient, kills at laſt, by producing peritoneal inflammation. —The chief circumſtance in the diſeaſes we have mentioned is, that the lymphatics do not take up the morbidly accumulated fluid: that this frequently ariſes from ſome defect in the action of thoſe veſſels, we collect from this circumſtance, that medicines now and then ſtimulate them to abſorption, and the morbidly accumulated fluids are removed. At other times, though no medicine whatever has been exhibited, the whole water of an aſcites has been removed in three days, from ſome ſtimulus in the conſtitution itſelf, given to thoſe veſſels.

It ſometimes happens that the cancelli and cavities of bones are obliterated or filled up; the bone, of courſe, contains more ſolid matter, and is heavier than natural. I ſuppoſe this to be owing to the lymphatics not counteracting ſufficiently the arteries, in removing the earth, in their uſual proportion to its being depoſited by the arteries. Moſt frequently, however, this is the effect of inflammation of bones.

In the ſecond place, diſeaſes may ariſe from the lacteals and lymphatics taking up too much of the healthy and apparently ſound ſolids and fluids of the body.—The abſorbents are always taking up the thinner part of the bile; but on particular occaſions, ſuch as a gall-ſtone ſticking in the common duct, and preventing the flow of bile into the inteſtine, the gall-bladder and the pori biliarii become uncommonly diſtended with the bile, and the lymphatics, to relieve this diſtenſion, abſorb the bile from their cavities, carry it into the blood-veſſels, and produce jaundice.

After a woman has lain-in ſome days, ſhe is ſometimes taken with ſhivering, and other ſymptoms of fever; her milk diſappears, the fever goes on, and ſhe dies. On opening the body, the cavity of the abdomen has on ſuch occaſions been found full of a whey-coloured fluid mixed with laminæ of coagulated white matter. The fever, by many, has in this caſe been attributed to the abſorption of the milk from the breaſt, and its being carried into the blood-veſſels; believing the appearances they ſaw in the abdomen to be from the milk, they have given it the name of Dépôt du Lait. I do not contend that the milk, in this caſe, is not abſorbed; but I believe that milk would do no miſchief in the blood-veſſels.

veſſels. The appearances in the abdomen are peculiar to the peritoneal inflammation, and would have taken place if the patient had been a male inſtead of a female. The whey-coloured fluid is the fluid of ſurfaces increaſed in quantity, and mixed with pus; and the curdled matter is the coagulable lymph very conſtantly found on inflamed ſurfaces.

There is another fluid, which the lymphatics alſo, on particular occaſions, take up, and carry into the blood: I mean the urine. I am perfectly confident of this, from attending to what has happened to myſelf on a great variety of occaſions. I have had the ſtrongeſt calls to make water, and felt that the bladder was full; but, not having it in my power to quit the company, the ſymptoms in ſome little time after have gone off. In an hour or two after, on attempting to make water, I found that the bladder contained little or none. I have not a doubt of the urine being abſorbed, and carried into the blood-veſſels. How often the lymphatics may remove the urine from the bladder, or why they do not always abſorb it in ſuppreſſions of urine, I do not know: an uncommon diſtenſion of the bladder may compreſs the orifices of the lymphatics, and make abſorption then impoſſible.

The ſoftneſs of the bones in the mollities oſſium, I believe, is owing chiefly to the lymphatics taking up the earth in too great quantity from the bones. We have ſeen large portions of bone removed, which were in themſelves perfectly ſound, in conſequence of the preſſure of ſome tumor on their ſurfaces; great part of the bones of the ſkull itſelf have in this way been removed.

In the third place, diſeaſes ariſe from the lacteals and lymphatics taking up morbid fluids generated in the body.—It is the opinion of one of the firſt phyſiologiſts, Mr. Hunter, that when variolous matter is inſerted into a wound, in the inoculation of the ſmall-pox, all that it does is to ſtimulate the ſurrounding parts to ſecrete a fluid ſimilar to itſelf, which being abſorbed, infects the conſtitution; and that the patient really receives the diſeaſe from variolous matter generated in his own body. The ſwelling of the glands of the axilla, which are ſymptoms of abſorption of the matter, certainly do not take place till the puſtule is fairly formed in the inoculated part; nor do the ſymptoms peculiar to the ſmall-pox

take place till after that period. It is poſſible that the venereal poiſon, and the poiſon of the mad dog, may be abſorbed in the ſame way; for they generally remain long in the part to which they were originally applied, and matter is commonly formed on that ſurface before the ſymptoms peculiar to theſe diſeaſes take place. There is one poiſon which is certainly generated in the body, but which muſt be abſorbed before it can infect the conſtitution: I mean the poiſon of cancerous matter. There is another fluid, the abſorption of which has been ſaid to produce very fatal effects in the conſtitution: I mean pus. Hectic fever and pulmonary conſumption have happened after large ſuppurations; but whether theſe are to be attributed to the pus being abſorbed, and carried into the blood-veſſels, or whether they are not rather to be aſcribed to the debility induced in conſequence of the irritation of long-continued ſores, may be doubted. The quick pulſe, in hectic fever, appears frequently to be a ſymptom only of irritation: accordingly, the pulſe has become ſlow and natural, when a limb, with the ſore which kept up this irritation, has been amputated; and hectic fever has been found to take place where there was no pus to be abſorbed. If hectic fever always followed the formation of pus, abſorption of this fluid might with more propriety be ſuſpected as the cauſe; but very large abſceſſes have been formed without it.

In the fourth place, the lacteals and the lymphatics increaſe, if they do not produce entirely, ſome diſeaſes of ſolids.—The lungs are affected with ſcrophulous inflammation: whether the lymphatics are the cauſe of this, I do not know; Dr. Hunter believed, from the univerſal ſwelling of the glands immediately under the ſkin, in ſcrophulous patients, that the lymphatics took up ſome noxious particles from the atmoſphere. But whether the lymphatics are the cauſe of the inflammation or not, they increaſe the diſeaſe, and render it more quickly fatal: they ultimately are concerned in the eroſion of the blood-veſſels of this viſcus, and fatal hæmorrhages frequently enſue: the ſubſtance of the lungs is gradually removed, and the advantage of breathing atmoſpheric air is diminiſhed in proportion to this loſs of ſubſtance; the debility increaſes, and the patient dies. I have known even the whole of the lungs of one ſide removed from this cauſe. In other parts of the body, part of the coats of arteries have alſo occaſionally been removed, and fatal hæmorrhages have thence enſued;

enſued: part of the coats of the inteſtines have been removed, and the fæces eſcaping into the cavity of the abdomen have produced peritoneal inflammation, and killed in a few days. A young lady to whom I was called, died after two or three days illneſs: before this ſhe had been in perfect health. I was at a loſs how to account for her death; but on opening the abdomen, I found the contents of the ſtomach in that cavity; that they had induced peritoneal inflammation, and killed. On examining the ſtomach, I found a hole in it large enough to admit the end of my finger; this hole had been formed by abſorption of part of the ſubſtance of the ſtomach: but its edges had adhered by inflammation to the under ſurface of the ſmall lobe of the liver, and the contents of the ſtomach, previous to the vomiting which brought on the cataſtrophe of the diſeaſe, by tearing away this part of the ſtomach from its adheſion to the liver, had thus been prevented from eſcaping into the cavity of the abdomen. I have known part of the ſubſtance of the brain itſelf removed; and there is hardly a ſolid in the body, which we have not ſeen, on ſome occaſion or another, ſuffer this loſs of ſubſtance.

In the fifth place, the lymphatics and lacteals take up irritating ſubſtances not generated in the human body; the infectious matter of diſeaſe from other perſons; poiſons, animal, vegetable, and mineral, from different quarters.—Boerhaave had an idea that the orifices of the lacteals would take up no fluid but what was perfectly globular and mild, and he conſidered this circumſtance as a guard on the conſtitution, with a view to the more certain preſervation of the animal: but every day's experience proves the contrary of this. The lacteals and the lymphatics take up the moſt irritating and ſtimulating ſubſtances. I have already mentioned that they took up ſpirit of turpentine, ſolution of cantharides, and ſolution of corroſive ſublimate. Arſenic itſelf may be abſorbed; and practitioners are obliged to deſiſt from its exhibition as a medicine, on account of the pain that, after a certain period, it always produces in the bones. A phyſician who had long reſided in Conſtantinople, told me that the plague was only to be caught by contact, and that the buboe was always found in that limb which had touched the infectious matter. There are ſome poiſons which kill inſtantly: whether theſe are abſorbed, or whether they act on the extremities of the nerves only, and through their medium on the whole nervous ſyſtem, I do not know. Not

only do the radiated extremities of the lacteals and the lymphatics take up the moſt ſtimulating ſubſtances, but their trunks, after thoſe radiated extremities are deſtroyed, appear to abſorb better than the original orifices. Venereal matter, having produced an ulcer, is almoſt immediately abſorbed; whereas, had the matter been applied to the original orifices, it might either not have been abſorbed at all, or not till after a conſiderable period. Theſe veſſels, then, introduce many diſeaſes into the body, independent of their producing diſeaſes. The infectious matter, however, may be frequently prevented from entering their orifices, by waſhing it off before it has had time to be abſorbed. Soap-lees diluted with water are every day employed as a waſh to prevent the abſorption of the venereal poiſon: it combines with the mucus in which the poiſon is entangled, and they are waſhed off together. It is in this way that the attendants on the lazarettos, by waſhing the ſurface of the body with ſoft ſoap, in which a conſiderable quantity of the fixt alkali remains uncombined with the oil, eſcape the infection of the plague itſelf. The ſurfaces to which infectious matter has been applied, may be cut out, or may be deſtroyed by the actual or the potential cautery, even after the poiſon has begun to act on the ſurface, and the abſorption may by this means be prevented. Even after the poiſon has entered the abſorbent veſſels, the remedy may frequently be made to paſs through the ſame veſſels, and its natural effects on the conſtitution may thus be prevented. Sometimes theſe veſſels take up poiſons which produce incurable diſeaſes, as we ſee in cancerous matter, when it has affected thoſe parts which are out of the reach of ſurgery: ſometimes, as I have ſaid, they deſtroy a vital part, and the ſame veſſels, which are of ſo much utility in preſerving the body at one time, are alſo frequently inſtrumental in deſtroying it. There are no general laws, however excellent in themſelves, that are not productive of ſome evil. It is by means of thoſe very properties which enable them to take up the moſt powerful remedies, that they take up infectious matter. It muſt alſo be remembered, that the human ſpecies were not intended to live for ever. Nature has not only provided for our exiſtence and duration for a certain period, but alſo for our diſſolution.

PART

PART II.

CONTAINING

A DESCRIPTION OF THE SITUATION AND NUMBER OF THE ABSORBENT GLANDS,

AND OF THE

PARTICULAR DISTRIBUTION OF THE ABSORBING VESSELS THEMSELVES,

IN THE HUMAN BODY.

INTRODUCTION TO PART II.

THE blood-veſſels of the human body have been frequently and accurately deſcribed by authors. The anatomiſts who have deſcribed parts of the abſorbent ſyſtem are alſo neither few nor obſcure; but the ſubject is really difficult; they have not hit on the proper methods of inveſtigation; they had not the advantages of proper ſubjects, and proper inſtruments; they were not ſufficiently maſters of their own time; they did not live to accompliſh what they had begun; or they laid before the public the produce of a fertile imagination, in the place of a true deſcription.

I have, in another part of this treatiſe, already mentioned the firſt writers on the abſorbents; and the reader is ſuppoſed to be acquainted with Aſellius, Veſlingius, Rudbeck, and Bartholine. Their united labours amounted to little more than the diſcovery of the lacteals, ſome lymphatics of the liver and teſticle, with the thoracic duct. Nor does any body appear, for a long time after, to have added any thing to their ſtock of knowledge. If I afterwards make it appear, that ſome other parts of this ſyſtem were known, yet, as this knowledge was not general, but confined to private ſocieties or perſons, and formed what Haller would call crepuſculæ lymphaticorum, it will not invalidate the general aſſertion I have now made. Haller knew all theſe facts I allude to; yet he ſays, "Poſt ea tempora, diu nihil acceſſit, & multum hæc hiſtoria etiam nunc a perfectione abeſt, neque in omnibus partibus corporis animalis hæc vaſa demonſtrata ſunt, neque ſyſtema abſolutum eſt, quale ad arterias corporis humani poſſidemus. Multæ enim partes corporis ſunt, in quibus vaſa lymphatica nemo vidit, aliæ ubi & raro quiſquam, & cum dubio aliquo. Ad alia enim inciſores

ſe converterunt, eorumque labores rei difficultas vicit."—We have, indeed, been informed, that Nuck had traced the abſorbents over the whole body; that he had engraved the appearances, and was going to publiſh them, when he was prematurely cut off. "Plura promiſerat Antonius Nuck, & poterat de ejus viri induſtria magna inciſorum expectatio eſſe. Integrum enim vaſorum lymphaticorum ſyſtema amalgamate repletum ſiccaverat, ſed pertinacem in eo labore virum, & per plura animalia ſua vaſcula perſequentem, mors ante diem abſtulit. Ad ea quæ edidit, utique brutis animalibus uſum eſſe conſtat, vel cordis exemplo. Non ideo tamen vir. cl. aut J. Henrici Schulzii acerbam accuſationem meritus eſt, aut Laurentii Heiſteri cenſuram, qui tabulas hujus viri pro fictitiis habent. Ipſe enim teſtimonium pro Nuckio dixit Hermannus Boerhaave, tabulaſque vaſorum lymphaticorum vidit, quæ argento vivo repleta vir induſtrius continuata ſiccaverat."

I ſhould be exceedingly ſorry to detract from the reputation of any induſtrious anatomiſt; but the appearances he has cauſed to be engraved are not like what I have ſeen. It is very evident, that he ſometimes deſcribed from the quadruped; it is to me alſo very evident, that he deſcribes from his own imagination. He is right in deſcribing the abſorbent glands as cellular; but neither his engravings of thoſe glands, nor ſome others that I have ſeen, very much reſembling them, are according to nature. Haller, indeed, ſays of him, "Pari facilitate vaſa lymphatica oſtendebat ut alii rubra," and that he injected theſe in vacuo: "Antlia pneumatica ad eum ſcopum uſum fuiſſe."—He alſo informs us, that he made uſe of an amalgam of quickſilver. This does not correſpond, however, with what he afterwards ſays: "Nuckium adipe aliquo argentum vivum coegiſſe." This mixture would not paſs into the abſorbent veſſels readily, in the way we now inject: I cannot ſay what might happen, if the veſſels were injected in vacuo; but I have a great many doubts on this ſubject.

Some attempts have ſince that period been made, and ſome things have been added to the hiſtory of the abſorbents, by Mekel, Hewſon, and Haller; but the deſcription is ſtill incomplete, as Haller himſelf confeſſes: "Ill. Meckelius paſſim ad eorum hiſtoriam aliqua addidit, tum Alexander Monro fil. & potiſſimum Guil. Hewſon, qui multas novas ex humano corpore tabulas dedit, etiam in artubus, & in his non ſola cuti

cuti vicina vaſa, ſed etiam profunda, neque prius dicta. Sparſim & ego, & in hominum cadaveribus, & in vivis animalibus, vaſa lymphatica & vidi, & perſecutus ſum. Plurima tamen ubique deſunt, neque in artubus, aut dorſo, aut interiori capite ea vaſcula hactenus ſatis certo viſa ſunt, neque conſtitutæ radices aut extremi termini."

The deſcription of the abſorbent ſyſtem I am about to give, is in moſt things the ſame with that which I gave at lectures twelve or thirteen years ago, as I formerly obſerved, particularly that of the abſorbents of the liver, and of the lungs, and pancreas, which were not known to Dr. Hunter himſelf; the laſt, particularly, neither to Haller nor Mr. Hewſon. Every year I added ſuch varieties as I had diſcovered. Moſt of the pupils at Windmill Street took notes; and copies of my deſcription are in the hands of a vaſt number of ſtudents.

I have uſed, in the Firſt Part of this treatiſe, the terms *lacteals* and *lymphatics*, inſtead of *abſorbents*, in order to avoid all ambiguity concerning the veſſels meant; but, having there diſproved abſorption by red veins, I cannot now be miſapprehended, and ſhall in future employ the term *abſorbents*, to ſignify *lacteals* and *lymphatics*; and ſhall write *glands of the abſorbents* inſtead of *lymphatic glands*. I muſt alſo remark, that neither the glands of the abſorbents, nor their veſſels, are ſo conſtant in their ſituation and diſtribution as the arteries; in which reſpect they reſemble the red veins. I have here deſcribed them as I found them moſt frequently.

Another general obſervation I wiſh alſo to premiſe is, that, independent of thoſe abſorbents which accompany the arteries, and which are uſually one on each ſide, there is on the extremities a ſet of cutaneous abſorbents, accompanying the larger trunks of the cutaneous veins, as the ſaphena major and minor, in the lower extremity; the baſilic and cephalic veins, in the upper extremity. There is alſo on the viſcera commonly a ſuperficial and a deep-ſeated ſet; the firſt run by themſelves, on the ſurfaces of the viſcera; the ſecond accompany the principal blood-veſſels of the viſcera, and ramify in the ſame manner. This diſtinction takes place even amongſt the abſorbents of the inteſtines themſelves.

Previous to the deſcription of the veſſels, I have thought proper to deſcribe the number and ſituation of the glands of the abſorbents, as they are more eaſily diſcovered. By this means I ſhall give an outline of the ſyſtem,

ſyſtem, which will facilitate afterwards the deſcription of the veſſels themſelves.

Many of theſe glands, from their bulk, may be diſcovered under the integuments, both by the eye and by the touch. When they are ſwelled or indurated, they are ſtill more eaſily diſcovered; and in the dead body, diſſection, with the utmoſt facility, diſcovers them in all the other parts where they exiſt. Both in the deſcription of the glands and of the veſſels, I ſhall begin at the greateſt diſtance from the terminations of the ſyſtem; viz. the angles of the jugular and ſubclavian veins, and follow the courſe of the abſorbed fluids moving in their veſſels: conſequently, I begin with the lower extremity. I have quoted Haller very often, not only becauſe I conſider him as the beſt anatomical author, on the whole, that we have, but alſo becauſe I find the anatomical knowledge of all his predeceſſors collected in his writings. He does not appear to have done much in this ſyſtem himſelf; but he knows every thing that has been done by his predeceſſors and cotemporaries.

A DESCRIP-

A DESCRIPTION

OF THE SITUATION AND NUMBER OF THE GLANDS OF THE ABSORBENTS.

THE POPLITEAL GLANDS.

I Have not ſeen any glands in the lower extremity, below the ham. Haller makes a ſimilar obſervation: "Senſim rariores factæ in poplite fere deſinunt, cum in tibia, fibula, pedeque nullæ mihi unquam occurrerint."—Mr. Hewſon deſcribes and delineates one very ſmall gland a little below the middle of the tibia, on the fore part of that bone, between it and the external integuments; but I have never once met with it; and would therefore conſider it as a kind of luſus naturæ. Dr. Hunter once found the glands even of the ham wanting. This circumſtance alſo I never met with. There are ſeldom more than three; they lie cloſe upon the popliteal artery; and, though ſmall, are by no means, as Haller ſays, "uti ultimæ conglobatarum, ita minimæ." There are many on the meſocolon, and in a variety of other places, much ſmaller than they are. They ſwell from ſores on the outſide of the foot, in the ſole of the foot, and from ſores of the integuments on the calf of the leg. Dr. Hunter mentioned a caſe of a patient who was bit by a mad dog in the calf of the leg: the ſore healed at firſt, but ſome weeks after broke out again. Red lines were perceived running upward from the ſore, with the ſaphena minor, which dipt down in the ham, and were loſt. They were inflamed lymphatics going to thoſe glands.

THE INGUINAL GLANDS.

THE glands of the groin are of an uncertain number, from eight, ten, or twelve, to twenty or more. Haller makes them only four. "Illas cum plures eſſe credidiſſem, accuratius numerans, quatuor inveni; octo faciebat Whartonus." They are ſituated, principally, above the faſcia of the thigh, though ſeveral of them lie under it. Theſe laſt are placed on the iliacus internus muſcle, between the triceps and ſartorius. Sometimes ſeveral of theſe glands are collected into one large one, which lies on the upper ſide of the inguinal artery. Thoſe which are neareſt the ſymphyſis pubis belong to the abſorbents of the parts of generation in both ſexes, and become, in the venereal diſeaſe, the ſeat of buboes. In ſome obſtinate venereal ulcerations of theſe glands, the coats of the ſubjacent inguinal artery have been ſo eroded, that from ſtraining the artery has burſt, and the patient inſtantly expired. A caſe of this kind was related by Dr. Hunter, as having happened in a ſoldier of the guards.—Thoſe on the outſide of theſe laſt-mentioned are more apt to inflame and enlarge, from ſcrophulous or other ſores on the inſide or top of the foot, from ſores on the inſide of the knee, or any where in the courſe of the ſaphena major. They may ſwell from ſores any where on the inſide or fore part of the leg and thigh. I have known them ſwell from wounds of the buttocks, and even from the inflamed and bleeding piles about the verge of the anus. When plaſters, producing ulcers in the integuments, have been applied to the ſkin, near the ſpine of the ilium, I have alſo repeatedly ſeen theſe glands ſwell. They ſometimes ſwell, and even ſuppurate, from ſympathy with an inflamed teſticle, though there is no connection between them by lymphatic veſſels. Haller and Nuck make theſe glands extend ſometimes to the middle of the ſartorius muſcle: "Aliquouſque cum magnis vaſorum truncis ad medium fere ſartorium deſcendunt, a quo muſculo, *ſartoriarum* nomen, Nuckius ſumſit, ab arteria, vero, crurales dixit." I have ſeldom ſeen any glands between the popliteal and inguinal glands, neither with the cutaneous nor deep-ſeated lymphatics.

THE EXTERNAL ILIAC GLANDS.

THESE alſo are of an uncertain number, from ſix to eight or ten, or even more, and are ſituated both above and below the external iliac artery and vein: "A magnis vaſis, eædem (glandulæ) cum eorum iliacis ramis cognomines, ad femora tendunt." Though the venereal poiſon muſt paſs through theſe glands, in its way to the blood, I know of no inſtance of their ever forming buboes; and it is very fortunate they do not; for if theſe, like the inguinal glands, ſuppurated, they could not be opened by the lancet, they muſt be left to themſelves—might burſt; the pus might fall into the cavity of the abdomen; might produce peritoneal inflammation, and might probably deſtroy the patient. It is very difficult to aſſign any reaſon for this, as cancerous matter not only affects the firſt glands it enters, but all the glands that lie between the ſore and the thoracic duct. Some have aſſigned, as a reaſon for the venereal virus not affecting the ſecond glands as well as the firſt, that the poiſon was diluted by being mixed with the lymph in the firſt gland. This is by no means ſatisfactory; ſince, even after it has been mixed with the whole maſs of blood, it is capable of producing ulcers in the throat, blotches on the whole ſurface of the body, and caries in the bones.

THE INTERNAL ILIAC GLANDS.

THESE alſo have been noticed by Haller.—Speaking of the former claſs, or external iliac glands, he ſays, "Ab eo agmine alter faſciculus in pelvim deſcendit cum vena hypogaſtrica ramoque ejus obturatorio." Their number is alſo uncertain; generally, however, more numerous than the former. They are apt to form large indurated maſſes, from diſeaſes, about the rectum, uterus, or bladder, which in many inſtances have proved fatal. A caſe of this kind Dr. Hunter attended. A woman was in labour, and could not be delivered in the natural way, from a tumor on the ſide of the pelvis preventing the child's head from coming

down. After ſhe was compleatly exhauſted, and the pains gone, he was obliged to deliver by the crotchet. The child, of courſe, was loſt; the mother fell into a fever, and died. Haller, ſpeaking of the ſame glands, ſays, " Funeſtis ſchirris obnoxiæ!"

THE SACRAL GLANDS.

HALLER blends theſe with the former claſs. They are connected with them, undoubtedly; but, lying more in the hollow of the ſacrum, and behind the rectum, I have conſidered them apart. Some of theſe are a continuation of the glands of the meſocolon, and belong to the rectum; others to the vagina, bladder, and glutæi muſcles. " In pelvi ultimas meſentericarum quæ rectum inteſtinum poſteriores comitantur, hæ ſacræ iterum adtingunt." Theſe, as well as the former, are liable to ſchirrus; and have ſometimes ſo compreſſed the rectum, as almoſt entirely to prevent the extruſion of the fæces: the patient has been wore out, and deſtroyed.

THE LUMBAR GLANDS.

THE bodies of the lumbar vertebræ, the lower part of the aorta, and cava inferior, are covered with a plexus of lymphatic glands, more numerous than any of the former claſſes. Under theſe the thoracic duct takes its origin; ſo that I am not ſurprized at Bartholin's conſidering them to be the real receptacle of the chyle in man. Haller ſays, " Cum vena cava, porro, anteriores glandulæ deſcendunt, per lumborum vertebras, lumbalium nomine; celebres toties Bartholino laudatæ, quas vir cl. ob numeroſa immiſta vaſa lymphatica, omnino pro vero in homine chyli receptaculo, habuit." Theſe, in cancers, and ſcrophulous affections of the teſticles and ovaria, are frequently enlarged and diſeaſed. " Grandes ſunt, & frequenter intumeſcunt." In the dead body of a man, whoſe left teſticle had formerly been extirpated on account of its being cancerous, I found the lumbar glands enlarged to the ſize of a child's head at birth, and encloſing the vena cava inferior, and aorta deſcendens, for ſome way.

THE

THE MESENTERIC GLANDS.

THEIR number is from between 130 to 140 or 150.—Ruyſch makes them vaſtly more numerous than I do; and ſays, that he has counted ſeventy glands in a portion of the meſentery not broader than the palm of his hand.—Haller does not ſay how many glands there are in the meſentery, but uſes the term plurima. "In adipe circa vaſorum inteſtinalium diviſiones, plurimæ glandulæ ſedent, ovatæ, compreſſæ, molles, tenera membrana obductæ, conglobati generis, cellulоſæ & ipſæ; in meſenterio quidem potiſſimum, tamen etiam in meſocolo tranſverſo, inque aliis meſocolis, etiam pone rectum inteſtinum. Iis glandulis cum thymo commune eſt, ſucco lacteolo in fetu adbundare, vaſculiſque innumerabilibus, deinde ea ætate ſucculentas eſſe, & in ſenibus demum diminui, & fere evaneſcere." This variety depends on this circumſtance—the inteſtinal canal is longer in ſome human bodies than in others; ſo much ſo, that it is ſometimes ſeven or eight times the length of the whole body; at other times not more than three times that length. The number of the glands, and the breadth of the meſentery, are almoſt always in proportion to the length of the inteſtinal tube, and of courſe to the number of the abſorbent veſſels. As the abſorbents are more numerous upon the jejunum, or ſuperior part of the inteſtinal tube, their glands are not only more numerous, but larger, on that part of the meſentery which correſponds to that inteſtine. Moſt of them are ſituated on the convex or left ſide of the ſuperior meſenteric artery. In the healthy ſtate of the body, even in the adult, the largeſt glands on the meſentery ſeldom exceed the ſize of an almond. It is very ſeldom that they are ſituate nearer the edge of the inteſtine than one or two inches. They are commonly ſcattered at a little diſtance from each other. Sometimes they are cluſtered, or accumulated; and in many quadrupeds they are only to be found in this cluſtered form, at the root of the meſentery. Aſellius found them ſo in the dogs; and, from their forming a line of ſome length at that place, as well as from other circumſtances, ſuppoſed them to be the pancreas. Although ſucceeding anatomiſts diſcovered his error, they ſtill continued to call this conglo-

meration

meration of the lymphatic glands, in thoſe animals, by the name of the Pancreas of Aſellius.

I have ſaid, that the glands of the abſorbents on the lower part of the meſentery, and towards the right ſide, are ſmaller and leſs numerous than thoſe toward the upper and left ſide; but the chyle from the lower part of the ilium, if it paſſes at firſt apparently through fewer and ſmaller glands, paſſes afterwards through a greater number, and even through the large glands at the root of the meſentery; ſo that what is not ſtrictly true reſpecting the veſſel, though aſſerted by Haller, is certainly true reſpecting the chyle abſorbed from the ilium. "Idem vas lacteum, quod mihi ſelegerim, ad quintam uſque glandulam, in ſuperficie meſenterii proſecutus ſum."

Theſe glands often become enlarged and indurated; this enlargement frequently depends upon a ſpecies of dyſentery and ulceration of the inteſtines. The abſorbents ariſing out of the ulcers carry the inflammation to the meſenteric glands, and become the cauſe of their enlargement. The glands of the meſentery alſo enlarge from ſcrophula, without any inflammation or ulceration of the inteſtines: and, as children liable to this complaint are generally very much emaciated, and ſoon after die, their emaciation and death has been attributed to the obſtruction in the glands preventing the chyle from entering into the blood; and the diſeaſe has been called tabes meſenterica, as I have already ſaid. Haller ſays, "Non alibi, in corpore humano frequentior ſchirro locus eſt & ſteatomatibus etiam lapideis concretionibus, ut omnino dudum earum tumor & ſchirrus pro cauſa peculiaris atrophiæ infantilis habiti ſunt." After which he exhibits a long liſt of indurations and enlargements of theſe glands:—"Schirrus enormis librarum decem—In atrophia meſenterium totum lapidoſum—Glandulæ meſenterii tumidiſſimæ, intus tartaro fetæ."—Diemerbroeck appears to have miſtaken the ſcrophulous ſuppuration of theſe glands for the ſtagnation and coagulation of the chyle in them: "In atrophia glandulæ meſentericæ tumidæ caſeoſo chylo plenæ." De Haen mentions a caſe where the meſentery, from the diſeaſed glands, weighed thirty pounds: "Tumor meſenterii cum hydatidibus, etiam cartilagineis partibus, triginta librarum pondere."

THE GLANDS OF THE MESOCOLON.

THE glands of the meſocolon are neither ſo large nor ſo numerous as thoſe of the meſentery. They are among the ſmalleſt in the body; and their number ſeldom exceeds twenty or thirty. They are ſituated nearer the edge of the inteſtine; but are alſo ſcattered not only along what is called the meſocolon, but on that fixt production of the peritoneum which belongs to the caput coli, and alſo to the ſigmoide flexure of the colon. They are alſo found on what Haller calls the meſocolon inferior, in the hollow of the ſacrum, what Dr. Hunter uſed to call the meſorectum. Haller ſays little or nothing of theſe glands: "Numeroſiſſimis illis meſenterii & meſocoli glandulis conjungitur." The meſenteric glands, at the time of the abſorption of the chyle, are of a pure white colour; but I never ſaw this happen to the glands of the meſocolon. Winſlow ſays, that he demonſtrated, to the Academy of Sciences, chyle in the lacteals of the great inteſtines. This I formerly obſerved I never ſaw. The chyle is principally found in the jejunum; and the contents of the ilium, towards its lower end, approach very much to the nature of fæces. In the great inteſtine I have never found any thing but fæces. The circumſtance of the glands being more numerous in the meſentery, along which almoſt all the chyle is carried, and being ſmaller and leſs numerous on the meſocolon, through which hardly any paſſes, looks as if the glands were intended to produce ſome remarkable change on the chyle. Theſe glands are not ſo liable to ſchirrus as thoſe on the meſentery; but are ſometimes enlarged, from cancers and ſchirri in the great inteſtines, which occur there more frequently than in the ſmall.

THE GLANDS OF THE OMENTUM AND STOMACH.

IT is ſeldom that any glands are found on the omentum till you come near the great arch of the ſtomach; they are about three or four in number, in the courſe of the gaſtrica dextra and ſiniſtra; and, though they belong to the omentum as much as to the ſtomach, have been conſidered by ſome anatomiſts as belonging to the ſtomach only, and been termed glandulæ

glandulæ ventriculi inferiores. There are ſome ſmall glands alſo on the edge of the little epiploon, where it adheres to the ſmall arch of the ſtomach; theſe, from their ſituation, have been termed glandulæ ventriculi ſuperiores.

The GLANDS of the LIVER, PANCREAS, and SPLEEN.

THE trunk of the vena portarum, near its entrance into the liver, is beſet with abſorbent glands; theſe I have ſeen diſeaſed, and diſtended to an enormous ſize, and compreſſing both the ductus communis choledochus, and the pancreatic duct, at the place of their inſertion into the duodenum: and this plexus is connected with another, which runs in the courſe of the ſplenic artery and vein, and belongs to the ſtomach, pancreas, and ſpleen.

The THORACIC GLANDS of the ABSORBENTS.

FROM the cavity of the abdomen we now go to the cavity of the thorax. The firſt glands we meet with in the cavity of the thorax, on the fore part of the pericardium, and upper ſurface of the diaphragm, are three or four in number; they are of a moderate ſize, and belong commonly to the abſorbents of the liver, ſometimes only to the diaphragm. There are others between the laminæ of the anterior mediaſtinum, three, four, or five; neither of theſe have I, on any occaſion, ſeen diſeaſed. On the oppoſite ſide of the pericardium, between the lamina of the poſterior mediaſtinum, there are abſorbent glands, which lie upon the œſophagus; a continuation of which are found, in moſt ſubjects, ſcattered on the external ſurface of that canal, throughout its whole length.

Along with the internal mammary arteries a number of ſmall glands are commonly found, under the cartilages of the true ribs, from ſix to eight or ten.—Sometimes, but rarely, the glands of the abſorbents are found within the ſubſtance of the lungs. They are conſtantly found, however, at the root of the lungs, both before and behind the bifurcation of the trachea, in the two bronchia. Haller ſays, "Quæ cum arteria aſpera

deſcendunt, eæ utrumque pariter ejus ramum comitantur, & pulmonis grandia vaſa circumſtant, & anteriores & poſteriores." Theſe glands belong to the abſorbents of the lungs, and may be termed the bronchial glands of the abſorbents; ſome of them frequently blend with others which lie upon the arch of the aorta, not unfrequently between the origins of the carotids, which may be termed the cardiac glands. The former glands are commonly of a blue, ſometimes of a black colour. When they are of the latter colour, their internal ſubſtance appears as it were broke down or diſſolved; and when cut into, reſemble ſo many little bags of ink; at other times are full of oſſifications, which ſometimes have ulcerated their way into the trachea, and bits of bone have been coughed up, to the aſtoniſhment of the practitioner, as well as of the patient. Bone may be coughed up from other cauſes, however. Dr. Hunter uſed to relate a caſe, and ſhew the baſis of the cricoid cartilage converted into bone, which, dying from ſome cauſe in the part itſelf, exfoliated, and was at laſt coughed up. The patient, for ſeveral months, coughed up blood and pus, though in ſmall quantities; was ſuppoſed to be in a conſumption; but on the bone's ſeparating, and being coughed up, he recovered.—Some glands are alſo continued from theſe, on the fore part of the trachea, all the way to the upper edge of the ſternum. I once knew an inſtance of theſe glands becoming ſchirrous, and forming a conſiderable maſs, which being prevented by the ſternum from puſhing forwards, preſſed backwards upon the trachea, and compreſſed it in ſuch a manner, that its cavity was gradually obliterating. The man was for ſome time incapable of the leaſt exertion or motion, without running immediate riſk of ſuffocation; and actually died one morning ſuddenly, as he was putting on his cloaths.

The ſides of the vertebræ of the back have a ſmall chain of glands continued as it were from the lumbar glands, through their whole length. Theſe glands are almoſt always to be found, and are commonly very ſmall; they belong to the abſorbents of the intercoſtal ſpaces, and ſeem to be ſo many guards on the thoracic duct, that no abſorbent may enter it, which has not previouſly paſſed through a gland.

THE GLANDS OF THE ABSORBENTS OF THE NECK.

THE glands of the neck are almoſt as numerous as thoſe of the meſentery; they are ſituated chiefly on the ſides of the neck; ſome of them lie immediately under the ſkin, and accompany the external jugular veins; but by far the greater number accompany the internal jugular veins and carotid arteries. "Porro hæc glandularum ſeries cum pharynge continuatur & ad latus & ad poſteriorem ejus faciem, ſecundum iter jugularis venæ & carotidis arteriæ——Verum agmen illud jugulare dextrum cum vena cava, utriuſque vero lateris cum aſpera arteria continuatur." Haller. Theſe glands frequently ſwell in children, from inflammations of the gums and alveolar proceſſes in teething, and recover after the teething is over. They frequently ſwell and enlarge from ſuppurations and ulcerations of the integuments on the top of the head; and they frequently inflame and enlarge from ſcrophulous diſpoſition alone. I have known them ſwell to an enormous ſize; and, though commonly accompanied with little pain, I have known the inflammation changed from indolent to active; and the pain and irritation of the parts, together with the affection of the mind, have worn out and deſtroyed the patient. Commonly, however, the ſcrophulous affection of thoſe glands is more offenſive to the eye of ſpectators, and troubleſome to the patient, than dangerous. As they are ſituated in parts which are not uſually covered, they are expoſed to every body's view, and almoſt conſtantly excite the idea of ſcrophula, and of the blood's being tainted with an hereditary diſeaſe, which may be communicated to the offspring of the perſon. The inflammation of thoſe glands not unfrequently terminates in ſuppuration. They burſt of themſelves, continue diſcharging for months or years, or alternately heal and break out again, till the age of fourteen or ſixteen; when the increaſed vigor of the conſtitution, and the changes that take place reſpecting the organs of generation, put a ſtop to the diſeaſe, the patient for the remainder of his life ſhews no more ſymptoms of ſcrophula, or at leaſt not till towards the end of life, when the vigor of the body declining, permits this diſpoſition again to ſhew itſelf.

Theſe

Theſe glands not only enlarge from particular affections of the teeth and jaws, and of the integuments on the outſide of the head, but from affections of the brain and its coverings; a proof not only of there being abſorbents in the brain, but of the courſe which theſe abſorbents take. Theſe glands alſo ſwell from ulcerations of the integuments in the nape of the neck.

THE GLANDS OF THE ABSORBENTS IN THE AXILLÆ.

THESE glands blend in with another plexus, ſituated under the clavicles and in the axillæ; theſe are not ſo numerous as thoſe of the neck, though in general they are larger. They belong to the abſorbents of the arms, of the breaſts, and of the integuments behind the ſcapulæ; and inflame and enlarge in particular affections of thoſe parts. They even receive abſorbents from the cavity of the cheſt; and I have known them ſwell from pleuriſy, peripneumony, and pulmonary conſumption. A nerve from the ſecond dorſal perforates the intercoſtal muſcles, and alſo goes to the axilla, at the ſame place with theſe abſorbents. Theſe glands, particularly, ſwell in cancerous affections of the breaſts of women. It is ſometimes poſſible to extirpate them with the diſeaſed breaſts themſelves, but more frequently their ſwelling on theſe occaſions is a mark of the diſeaſe being incurable; and I have known them form a ſchirrous maſs, and ſurround the axillary artery in ſuch a manner, that it was impoſſible to extirpate them, without extirpating that part of the artery too. In moſt of the caſes of cancer in the breaſt, where theſe glands have been extirpated, the diſeaſe returns, becauſe it is almoſt impoſſible to find out or extirpate all the infected glands; or the arm ſome time after becomes œdematous, becauſe the trunks of the abſorbents have been cut through, and afterwards included in the cicatrix.

GLANDS OF THE ARM.

THESE alſo are of an uncertain number, from three to ſix or ſeven in each arm, and placed in no certain order: they occupy the inſide of the arm, from the axilla to the internal condyle of the humerus, where there is almoſt conſtantly one gland, in each arm, to be found on the anterior ſurface of that condyle. They run principally with the brachial artery. I have known the laſt-mentioned glands die, and ſlough out in ſcrophula, without any great inconvenience.

GLANDS OF THE FACE.

THERE are ſome ſmall glands belonging to the abſorbents on the ſides of the face; the uppermoſt of theſe are immediately under the zygomatic proceſſes of the temporal bones, others lie on the external ſurfaces of the parotid glands, as well as on the buccinator muſcles. There may be four, five, or ſix of each ſide; ſometimes there are none. There are alſo ſeveral glands about the angles of the lower jaw, and on its baſe, between theſe angles and its ſymphyſis. There are conſtantly two behind and upon the mammillary proceſſes of the temporal bones, but theſe are rather to be conſidered as the uppermoſt of the neck than belonging to the head.

WHERE THERE ARE NO GLANDS OF THE ABSORBENTS.

HAVING thus pointed out in what parts of the body the abſorbent glands are chiefly to be found, it will naturally be aſked, Are there no glands to be met with in the other parts of the body? I do not ſay that they are never found any where elſe. Anatomiſts may yet find them in parts where I have not ſeen them. We are every day finding ſome luſus naturæ in the arteries, veins, and nerves; and, as the abſorbent ſyſtem allows of a ſtill greater variety, other glands may yet be ſeen than thoſe

which I have deſcribed. But I have ſeen no glands on the feet, none on the legs below the ham, none between the integuments of the thigh and the muſcles, different from thoſe deſcribed. Others have ſeen thoſe that ſometimes, as it would appear, accompany the femoral artery in the middle of the thigh; I have ſeen none between the ham and the groin. I never ſaw any either under the integuments or among the muſcles of the nates. I have met with none, on the poſterior part of the trunk of the body, different from thoſe I have already deſcribed; nor on the anterior part, except ſome ſmall ones on the breaſts of women, ſituated between the nipple and the axilla. There are none on the hands. I never ſaw any in the fore-arm. There are none on the outſide of the cranium; none on the inſide, either in the coverings or in the ſubſtance of the brain. The pituitary gland has ſome reſemblance to the glands of the abſorbents; but when cut into, it evidently conſiſts of two ſubſtances; in which reſpect it reſembles the renal capſula of quadrupeds: one upon the outſide, which may be called cortical; and another on the inſide, which, were we to compare it to the ſubſtance of the brain, may be called medullary. There is nothing of this appearance in the glands of the abſorbents of the human body. No abſorbent veſſels have been yet traced into it; we therefore do not know whether it is or is not a gland belonging to the abſorbents.

OF

OF THE

PARTICULAR DISTRIBUTION

OF THE

ABSORBENT VESSELS themſelves,

IN THE DIFFERENT PARTS OF THE BODY.

ABSORBENTS of the Lower Extremity.

I Have, in a former part of this work, demonſtrated that the trunks of the abſorbents are at leaſt double the number of the larger arteries. Some have imagined that this ſuperiority in number did not extend to the minute branches; but the annexed engraving of the deep-ſeated lacteals will ſufficiently demonſtrate that this ſuperiority in number is kept up there alſo. I have occaſionally ſeen, immediately under the common integuments on the top of the foot, innumerable ramifications of the abſorbents, and exactly the ſame appearance as in the ramification of arteries themſelves. Bartholin and Steno appear firſt to have ſeen ſomething of theſe veſſels in quadrupeds; but Van Horne was the firſt who ſaw them in the human ſubject. This I take on the authority of Haller: "Ea vero in humano crure oſtendit Johannes Van Horne." The larger abſorbents of the lower extremity are formed into two ſets, ſuperficial, and deep-ſeated; the ſuperficial ſet accompany chiefly the cutaneous veins, and the deep-ſeated accompany the arteries. The cutaneous

taneous veins of the lower extremity form two principal trunks; one of theſe is named ſaphena major, and the other ſaphena minor. The greater number of the cutaneous abſorbents accompany the ſaphena major; and I have long diſtinguiſhed them by the name of *vaſa lymphatica venam ſaphenam majorem comitantia.* Some abſorbents ariſe from the ſides of the toes, in the ſame manner as the arteries, two and two. But, beſides theſe, there is a net-work of abſorbents compleatly ſurrounding the toes. The two lateral abſorbents accompany the deep-ſeated arteries; the net-work upon the outſide belong to thoſe which accompany the cutaneous veins. They form four great diviſions; the firſt ariſes from between the great toe and the one on its outſide, where the ſaphena major commences, and conſiſts of ſix or ſeven veſſels; they run over the top of the foot, with that vein, towards the fore part of the inner ancle; from thence they run, in company with the vein, towards the inſide of the knee, where they are joined by others, preſently to be deſcribed. The ſecond diviſion, which I have ſeen conſiſting ſometimes of eight or ten veſſels, ariſe about the middle of the inner edge of the foot, paſs behind the inner ancle, and, running over the inſide of the calf of the leg, join the laſt-deſcribed veſſels on the inſide of the knee. The third diviſion, conſiſting of five or ſix veſſels, ariſe near the little toe, run over the outer and upper ſide of the foot, in the direction of the outer ancle; when they come near it, they divide into two; one part croſs over the anterior part of the tibia, and go likewiſe to the inſide of the knee, where they join the two former diviſions.—It happened once, that when I was injecting this plexus with quickſilver, I injected a portion of the ſkin to great minuteneſs, the mercury having run contrary to the valves, into exceeding fine extremities of the abſorbents. The part where this happened, as well as the veſſels from whence it was injected, are ſeen in the largeſt annexed figure.—From the union of theſe three diviſions, a grand plexus is formed, conſiſting of fourteen, ſixteen, or twenty trunks of the abſorbents, which ſtill continue to accompany the ſaphena major; that is, to run obliquely from the inſide of the knee to the middle of the groin; there they commonly go into the different inguinal glands already deſcribed. But, in the moſt ſucceſsful injection that I ever made of theſe veſſels, they terminated in one gland, as will be ſeen in the

the annexed figure. It frequently happens, that two or three of theſe trunks paſs by the glands of the groin, and are not inſerted into any gland till they have paſſed under Paupart's ligament. Part of the laſt diviſion, viz. that coming from the little toe, join another which ariſes from the middle of the outer edge of the foot, where the ſaphena minor commences, and accompanying that vein, paſs behind the outer ancle; from thence run on the outſide of the tendo achilles, go afterwards between the bellies of the gaſtrocnemeus muſcle, and, dipping down between its heads, near the place where they are inſerted into the condyles of the os femoris, terminate in the glands of the ham, already deſcribed. Theſe I have long d ſtinguiſhed by the name of *vaſa lymphatica venam ſaphenam minorem comitantia*. Theſe are not above one fifth ſo numerous as the former. The deep-ſeated abſorbents ariſe, as I have ſaid, from the ſides of the toes, along with the arteries, two on each ſide, as the deep-ſeated veins. Part of theſe accompany the anterior tibial artery, on the top of the foot; and I have long diſtinguiſhed them by the name of *vaſa lymphatica arteriam tibialem anticam comitantia*; they accompany it through its whole courſe, with it, perforate the interoſſial ligament, between the tibia and fibula, and terminate in the glands of the ham: but the principal part accompany the arteries plantaris externa & interna, in the ſole of the foot, and afterwards the poſterior tibial artery through its whole courſe, and terminate alſo in the glands of the ham; theſe I have long named *vaſa lymphatica arteriam tibialem poſticam comitantia*. I have once or twice alſo ſeen the abſorbents accompanying, in the ſame manner, the peroneal artery. Though I have not injected them with quickſilver, I have inflated them with air, and have no doubt but that they terminate in the ſame glands. From the glands of the ham, two grand trunks emerge, as vaſa efferentia principally to the deep-ſeated abſorbents now deſcribed, but alſo to the cutaneous abſorbents which accompanied the ſaphena minor; theſe run one on each ſide of the femoral artery: I have uſually called them *arteriæ cruralis comites*. Theſe frequently communicate with one another by croſs canals, and their branches ſometimes form circles which compleatly ſurround the artery. In one caſe they both terminated in the ſame gland in which the greater number of the cutaneous abſorbents had terminated; but more frequently they terminate in three or four of the larger glands, which

which lie on the upper or under ſide of the inguinal artery. The glands and the veſſels together I have uſually named *lymphaticorum plexus inguinalis.* From theſe glands ſeveral trunks emerge. I have occaſionally ſeen two; ſometimes four; and, the very laſt time that I injected them, which was laſt ſummer, there were ſix: theſe I have been uſed to name *efferentia inguinis.* The principal trunk lies under the faſcia of the thigh, immediately in contact with the upper ſide of the inguinal artery, and a little above that paſſes under Paupart's ligament, where it immediately enters into the glands that are upon the ſides of the external iliac artery; and, being joined with other ſmaller trunks from the thigh, forms a very elegant plexus of veſſels and glands, all the way to the lowermoſt vertebra of the loins; which I have uſually diſtinguiſhed by the name of *lymphaticorum plexus iliacus externus:* ſometimes the principal trunk, without entering any gland, accompanies the iliac artery till it is loſt in the lumbar glands. I have ſometimes found it paſſing along theſe, without entering any of them, and going immediately into the beginning of the thoracic duct, where, joined by a ſimilar trunk from the oppoſite ſide, they might be ſaid, as it were, to form the two crura of the thoracic duct. Some of the ſmaller vaſa efferentia of the groin lie above the faſcia of the thigh, and, before they paſs under Paupart's ligament, are obliged to perforate the faſcia in ſo many different places. When the abſorbents of the thigh form one large trunk, lying on the upper ſide of the inguinal artery, I have diſtinguiſhed it by the name of *efferens inguinis maximum.* If the operation for the inguinal aneuriſm was to be performed in ſuch a caſe, this trunk muſt be tied up with the artery, the leg muſt become œdematous, and there would be a ſtagnation of lymph in almoſt all the abſorbents of the lower extremity. About two years ago I injected the trunks accompanying the femoral artery:—a little above the middle of the thigh they ſplit into four branches; theſe ſubdividing, formed about ſeven or eight; ſome of theſe were inſerted into glands on the inſide of the inguinal artery, but the principal veſſels went with it under Paupart's ligament, into the cavity of the abdomen, and were inſerted into the external iliac glands.

The

The ABSORBENTS of the PENIS.

THESE likewiſe may be divided into a ſuperficial and deep-ſeated ſet. The ſuperficial abſorbents ariſe from the prepuce, in three diviſions; one on the right ſide of the frænum, another on the left, and the third directly in the middle, on the ſuperior ſide. Thoſe from the under ſide make a ſemicircular turn, from the under to the upper ſide of the penis; whilſt that on the ſuperior part of the prepuce runs on the middle of the dorſum penis, exactly in the direction of the ſymphyſis pubis. At a little diſtance from the ſymphyſis, the three diviſions unite into one common trunk, which almoſt immediately ſeparates again into two. One of theſe trunks goes to the right groin, accompanies thoſe veins which go to the inguinal vein, and terminates near it in thoſe inguinal glands which are neareſt the ſymphyſis pubis. The other trunk goes to the left groin, and terminates exactly in the ſame manner as the former. I have uſually named theſe *penis lymphatica cutanea.* It is from this circumſtance, that when venereal matter is abſorbed from a chancre on the prepuce, red lines are ſometimes ſeen running on the body of the penis, and terminating in the groin: theſe are the abſorbent veſſels inflamed by the irritation of the poiſon. This inflammation ſeldom laſts above a day or two. At other times they put on the appearance, and have the feel of ſmall cords: theſe alſo go off in a few days. At other times the veſſels not only inflame, and form indurations, but alſo ſuppurate in different places, and form what has been called buboes of the penis. The deep-ſeated ones accompany the arteries, and paſs with them on the inſide of the tuberoſities of the iſchia, or under the angle of the pubis. If the venereal virus forms a chancre on the prepuce, a buboe is frequently the conſequence, in one of the glands of the groin; but if the chancre is formed on the glans penis, there is ſeldom a buboe in the groin, and yet the conſtitution is infected as certainly as in the former caſe. The inguinal glands ſometimes inflame and ſuppurate merely from ſympathy with the urethra, though no venereal matter be paſſing through them: this we ſee ſometimes in gonorrheas cured without mercury; where, notwithſtanding, ſymptoms of the lues venerea in the conſtitution appeared afterwards. The

ſame thing frequently happens when bougies have been introduced, with a view to the cure of a ſtricture in the urethra. Theſe abſorbents may be termed *lymphatica penis profundiora.*

The ABSORBENTS
OF THE EXTERNAL PARTS OF GENERATION IN WOMEN.

THE abſorbents from the clitoris, and beginning of the vagina, alſo form two diviſions; one of theſe, as in the male, goes to the inguinal glands of each ſide; the other runs up with the round ligaments towards the rings of the external oblique muſcles of the abdomen, and may either paſs into the glands on the inſide of Paupart's ligament, or, blending with the abſorbents of the uterus, moſt probably terminate in the lumbar glands. This arrangement of theſe veſſels will explain what we commonly ſee taking place, as the conſequence of chancres in women—If the chancre is near the meatus urinæ, the red lines, which mark the inflamed abſorbents, are ſometimes ſeen running in the courſe of the round ligament; and ſuppurations, ſimilar to the buboes of the penis in men, alſo ſometimes take place; but if the chancre be ſituated any where near the perineum, the red lines are ſeen running in the direction of the groin, and the buboe has the ſame ſituation that it uſually has in men.

Some other ABSORBENTS,
TERMINATING IN THE GLANDS OF THE GROIN.

I HAVE ſeen abſorbents injected with quickſilver, which aroſe from the buttocks and poſterior part of the thigh, and which, paſſing between the integuments and muſcles of the outſide of the thigh, were inſerted into thoſe inguinal glands which are neareſt the ſpine of the ilium. The following appearances ſhew, that the abſorbents about the verge of the anus, as well as the abſorbents of the lateral part of the abdomen, are inſerted in the glands of the groin. Where the piles have been very much inflamed or ſuppurated, I have repeatedly ſeen the inguinal glands ſwell; and where ulcerations have been produced

in the integuments which cover the poſterior edge of the obliquus externus, the abſorbent glands of the groin have alſo ſwelled.

The ABSORBENTS of the TESTICLE

MAY be divided into four claſſes: thoſe of its coats, thoſe of the body of the teſticle, thoſe of the rete teſtis, and thoſe of the epididymis. The firſt I have uſually diſtinguiſhed by the name of *lymphatica tunicæ vaginalis*; the ſecond, by the name of *lymphatica teſtis profundiora*; the third, *lymphatica rete teſtis*; and the fourth, by the name of *lymphatica epididymidis*. The abſorbents of the tunica vaginalis are eaſily diſcovered, lying between the reflection of that coat and the tunica albuginea. Though they are thus ſituated, I know that they belong equally to the body of the teſticle: they are in great numbers, and I have ſometimes covered the albuginea with abſorbents injected with quickſilver; perhaps there is not any part of the human body where the abſorbents are larger or more numerous, in proportion to the part, than here. They ſoon leave the albuginea, and get upon the cord, where they are joined by others, to be deſcribed preſently; but the tunica vaginalis has alſo other abſorbents, upon the anterior and lateral parts, which have not the leaſt connection with the body of the teſticle, nor with the albuginea, and which alſo ſoon blend with the former, on the beginning of the cord. The abſorbents which ariſe out of the rete teſtis are exceedingly large, and appear to have no connection with its coats. A very beautiful preparation of theſe veſſels I made at Windmill Street, at leaſt ten years ago: I injected the vas deferens with quickſilver, and had in view not only the filling of the epididymis, but the tubuli teſtis themſelves. I had forced the mercury along the epididymis, and was delighted to ſee it get into the body of the teſticle; the mercury continued to deſcend very quickly through the glaſs injecting tube, but I ſoon found that it was not running into the tubuli teſtis, but into ſome veſſels which mounted along the cord; theſe I ſoon perceived were abſorbents. The preparation was dried, afterwards put into oil of turpentine; the abſorbents were then, and are now, diſtinctly ſeen riſing out of the rete teſtis. I have alſo injected them from every part of the epididymis, from its ſuperior extremity, from the middle, and from

the lower end. The vaſculum aberrens Halleri is not an abſorbent veſſel, and cannot poſſibly return the ſemen to the blood; it is a luſus naturæ, and either forms a cul de ſac, or, after many convolutions, returns back again upon itſelf, and terminates where it began. It ſometimes mounts four inches upon the cord, and then terminates in a cæcum or blind pouch. Sometimes it is not a quarter of an inch in length. I have ſeen it convolute like the epididymis itſelf; from which it could not be diſtinguiſhed, till by maceration and diſſection the cellular membrane had been removed. It may be compared with the diverticulum ilii, ſo frequently met with in the human inteſtines. The abſorbents having reached the cord, form from ſix to twelve trunks, or more; ſome of theſe are ſometimes larger than a crow-quill: they do not appear to anaſtomoſe with one another as they paſs along the cord; at firſt they run ſtraight upwards, in the direction of the ring of the external oblique muſcle; after which they are bent upon themſelves, and paſs a little way in the direction of the ſpine of the ilium; after which they are bent as it were a ſecond time upon themſelves, and run over the anterior ſurface of the pſoas muſcle, and terminate at laſt in the lumbar glands. The reaſon of their termination, ſo diſtant from their origin, will eaſily occur to thoſe who reflect that the original ſituation of the teſticle was at this place, and that it was natural for it, like the other viſcera, to receive its blood-veſſels and nerves from the neareſt trunks, and to return its abſorbents to the neareſt glands. I have already ſaid, that, in ſchirrus or cancer of the teſticle, theſe glands were ſometimes infected, and enlarged to an immenſe ſize. Nuck appears to have been the firſt who ſaw the lymphatics of the teſticle. Haller ſays, "Olim Cl. Nuckius flatu per venas ſpermaticas impulſo hæc vaſa diſtenderat, & ad quadraginta vaſa lymphatica ex albuginea tunica naſci, in quinque ramos confluere, ſuamque lympham in ciſternam chyli deponere docuerat: aliud vero vaſculum cum ductu deferente ad ureteram tendere, pariterque prope renes in ciſternam finiri. Ligatis vaſis ſpermaticis, Graafius utebatur, & ejus præceptor Sylvius." There is a circumſtance in this deſcription which renders it ſuſpicious; that is, his aſſerting that they terminated immediately in the receptacle of the chyle. In all my injections of thoſe veſſels, they have conſtantly terminated in the lumbar glands. Dr. Joliffe appears to have been

been the firſt who ſaw thoſe veſſels on the ſpermatic cord of the living human ſubject, as I have formerly obſerved. Haller appears alſo to have ſeen them, but, with his uſual candor and modeſty, confeſſes that he knew very little either of their origin or termination. "In homine aliquoties vidi majuſcula, non tamen valde numeroſa, in funiculo ſeminali cum venis adſcendentia, valvuloſa, ut tamen neque originem, neque finem ſatis accurate viderem."

The ABSORBENTS of the UTERUS.

AS the uterus has two ſets of arteries and veins, it has alſo two ſets of abſorbent veſſels: one of theſe is the largeſt, and accompanies the hypogaſtric arteries and veins; I have uſually named them *lymphatica hypogaſtrica*. The other is ſmaller, and accompanies the ſpermatic arteries and veins; and which I have uſually diſtinguiſhed by the name of *ovarii lymphatica ſpermatica*. In the gravid uterus, the trunks of the hypogaſtric abſorbents are as large as a gooſe-quill, and the veſſels themſelves ſo numerous, that, when they only were injected with quick-ſilver, one would have been almoſt tempted to ſuppoſe that the uterus conſiſted of abſorbents only. In the unimpregnated uterus they are not ſo eaſily detected; but, when that viſcus has been injected by the arteries and the veins, and has afterwards been macerated in water for ſome days, the air then produced in the cellular membrane, by putrefaction, gets into the abſorbent veſſels, and makes them perfectly diſtinct. The hypogaſtric plexus paſs from above downwards, into glands which are ſituated on the ſides of the vagina; which enlarge, as the veſſels themſelves do, in the impregnated ſtate, though they are almoſt inviſible in the unimpregnated ſtate: from theſe glands the trunks of theſe veſſels paſs to other glands, ſurrounding the internal iliac artery and vein, and which have been already deſcribed; the glands and veſſels together I have diſtinguiſhed by the name of *lymphaticorum plexus iliacus internus*: from theſe they paſs into the lumbar glands, and there blending with the trunks from the lower extremities, they paſs into the thoracic duct. On the internal ſurface of the gravid uterus, at that part where the placenta had formerly adhered, I have ſeen the quick-ſilver,

ſilver, which I had thrown into theſe veſſels from the external ſurface of the uterus, eſcaping at torn extremities of veſſels which had been paſſing into the placenta, even contrary to the valves.

The abſorbents which accompany the ſpermatic artery and vein are neither ſo large nor ſo numerous as the former; they belong chiefly to the ovarium, fallopian tube, and the round ligament; they anaſtomoſe with the former in ſuch a manner that they are frequently injected from them; this cannot happen in any other way than contrary to the valves. They run up on the ſpermatic cord, without paſſing through any gland, till they come to the ſame place where the abſorbents of the teſticle terminate in the male; there they alſo terminate, in glands ſituated on the ſides of the vertebræ of the loins: from theſe glands they paſs out, and blending with the lumbar plexus, get into the thoracic duct. In quadrupeds the abſorbent veſſels of the uterus are very eaſily diſtinguiſhed, and they ramify exactly as the arteries and veins.

The abſorbent veſſels of the human uterus were firſt ſeen by Mery, afterwards by Morgagni and Winſlow. Haller ſays, "Vidit in humano utero Johannes Mery, in omnibus ad inſtrumentum genitale pertinentibus partibus; tum I. B. Morgagnus in puerpera, turgida, ſub membrana externa uteri repentia; & I. B. Winſlow."

He himſelf appears never to have ſeen them: "Etſi in homine ea vaſa nunquam mihi contigit vidiſſe, vidi tamen in majoribus beſtiis etiam manifeſtiſſima."

The ABSORBENTS of the BLADDER.

THESE, in both ſexes, accompany the principal veins on the bladder, and at the bottom, on the right and left ſide, paſs into the glands ſurrounding the internal iliac artery and vein, but previous to this they frequently paſs into ſmall glands ſituated on the ſides of the bladder itſelf. Zellerus has given a deſcription of thoſe veſſels, in a treatiſe, which I have not ſeen. Haller ſays "Zellerus vaſa lymphatica (veſicæ) injecto vinculo confirmavit;" and, though Haller had not ſeen the abſorbents themſelves, he had ſeen the ſmall glands which

I have

I have mentioned, and for that reaſon has no doubts of Zellerus's deſcription. He ſays, "In veſica quidem non vidi, ſunt tamen in celluloſa tela, ei circumpoſta glandulæ conglobatæ, quæ rei fidem faciunt."

I have uſually diſtinguiſhed theſe by the name of *veſicæ lymphatica.*

The ABSORBENTS of the RECTUM.

AS the blood-veſſels of the rectum are in proportion larger than in moſt parts of the great inteſtines, ſo are its abſorbents. It is alſo ſurrounded with abſorbent glands. Mr. Hewſon ſays, "The lymphatic veſſels ariſe even from the rectum, as can be ſeen in quadrupeds that are opened immediately after death, or in fiſh when a coloured injection is thrown into their lymphatic ſyſtem." He ſeems to me to have had no adequate idea of the abſorbent ſyſtem: I could as eaſily conceive a part to be without arteries and veins as without abſorbents. Haller ſays, "Qui negaverunt craſſis inteſtinis lactea data eſſe, ii non ſatis ad difficultatem negationis univerſalis adtenderunt." Mr. Hewſon ſhould have known, that the abſorbents of the rectum were the firſt diſcovered after thoſe of the liver, by Rudbeck; and, from the authority I laſt mentioned it appears, "Prima etiam lymphatica vaſa, quæ præter hepar in homine viſa ſunt, ea in recto inteſtino adparuerunt." Auerbach alſo aſſerts, that he had ſeen the abſorbents of the rectum with his naked eye; "Sibi nudo oculo in elapſo inteſtino viſa eſſe." Haller is here obliged to reject the exiſtence of the ampullula; and the reaſon he gives us is, that there are no villi formed on the internal ſurface of the rectum. He ſays, "Cum villi hic nulli ſint, neceſſe eſt, etiam alio modo & abſque ampullula, chylum de inteſtino poſſe ſorberi." The lymphatics of the rectum, having paſſed the glands that lie upon it, terminate at laſt in the lumbar glands, where, blending with the larger trunks of the abſorbents, already deſcribed, the fluids they have abſorbed are carried to the thoracic duct. Thoſe I have uſually called *lymphatica hæmorrhoidea interna.*

The

The ABSORBENTS of the HIPS.

THESE I have uſually diſtinguiſhed by the name of *lymphatica ſciatica*. Some of theſe, I have already ſaid, go round by the great trochanter of the thigh to the glands of the groin; or paſs on the inſide of the thigh, between it and the ſcrotum, to the ſame glands: but by far the greater number go in at the ſciatic notch, with the arteries glutea and ſciatica, and terminate in the glands ſurrounding the internal iliac artery and vein; and when they have paſſed through thoſe glands, they terminate at laſt in the lumbar glands, from whence their fluids go into the thoracic duct.

The ABSORBENTS of the KIDNIES.

THE abſorbents of the viſcera are commonly found in two ſets; one which runs on the external ſurface of the viſcus, and another deep ſeated, which accompanies the larger blood-veſſels. In the ſound ſtate of the kidney, I have very ſeldom ſeen the ſuperficial abſorbents; but in caſes where the kidnies were diſeaſed, and formed into large hydatids, thoſe veſſels, which, in the ſound ſtate of the viſcus, from their minuteneſs are with great difficulty ſeen, having enlarged with the diſeaſed parts, become perfectly diſtinct. They run from the outer edge of the kidney towards the inner, where they either blend in with the deeper-ſeated ſet, or go ſeparately to be inſerted into the lumbar glands, already deſcribed. Nuck's engravings of theſe veſſels appear to me highly ſuſpicious. Theſe I have uſually diſtinguiſhed by the name of *lymphatica renis exteriora*. In a diſeaſed kidney, where its ſubſtance, in conſequence of ſtones being contained in the pelvis, had ſhrunk, and left the principal branches of the veins and arteries naked, I injected nine abſorbents with quickſilver; which run upon the outſide of the blood-veſſels, and ramified as they did. When they came near the trunks of the emulgent artery and vein, they were more cloſely collected into a plexus, and, running nearly parallel to each other, terminated at laſt in the lumbar glands, a little to the outſide of the

origin of the emulgent artery. Thoſe I have uſually diſtinguiſhed by the name of *lymphatica renis profundiora*. By making a ligature upon the emulgent vein, and compreſſing the ſubſtance of the kidney, whilſt it was in ſitu, I have forced the blood, which had tranſuded into the cellular ſubſtance of that viſcus, into the mouths of the abſorbents, and thence into their branches; they have then ſhewn themſelves to have been exceedingly numerous, at leaſt equal to the blood-veſſels. It is in this ſtate I have repreſented them, in the ſubſtance of the kidney, in the large figure annexed.

There is alſo in the kidney another ſet of abſorbents, belonging to the pelvis and ureter. I attempted to inject, if poſſible, the tubuli uriniferi with quickſilver from the ureter; for this purpoſe I increaſed the column of mercury as much as I could; but, inſtead of filling theſe veſſels, the mercury returned through the lymphatics on the outſide of the ureter, and ran in the direction of the inferior lumbar glands. Theſe may be termed *ureteris lymphatica*. "Trunculos quidem in omni cadavere facile eſt in vena renali detegere, per quos ipſe ductus thoracicus non incommode repletur, in quem ſe conferunt. Non ita facile eſt in renes deducere: quare artificium ſolent addere, venamque ligant, & per arteriam aquam impellunt, aut per venam, per ureterem denique: aut vaſa certe venoſa renis ligant, quo vincula una ea vaſa comprehenſa ex ſua indole turgeſcunt. Denique ſola putredo, quæ cellulas inflat, etiam vaſa lymphatica patefacit." Haller.

The ABSORBENTS of the RENAL CAPSULÆ.

THESE I have been in the habit of diſtinguiſhing by the name of *lymphatica capſulæ renalis*. The principal veins of the renal capſulæ join the emulgent veins; ſo do their principal abſorbents join thoſe of the kidnies, and of courſe have the ſame termination. I have frequently obſerved the abſorbents of the neighbouring parts paſſing over the renal capſulæ, and blending with their abſorbents. Heuerman ſays, he has ſeen at leaſt ſeven or eight lymphatics ariſing out of the renal glands. Haller's expreſſion is, "Etiam in capſulis renalibus aliqua (lymphatica) viſa ſunt."

The

The ABSORBENTS of the INTESTINES.

I HAVE already ſaid, that Eraſiſtratus had ſeen the lacteals in kids, but ſuppoſed them to be arteries.—Haller ſays, "Vaſa lacte plena invenit, ſed præjudicio claudente oculos, inanes arterias, ad ſuam hypotheſin putavit ſe videre."—Herophilus alſo, about the ſame time, appears to have ſeen the ſame veſſels, which he diſtinguiſhes by the name of the nutrient veins. The ſame author obſerves, "Eodem fere tempore Herophilus, magnus inciſor, in junioribus pariter animalibus vidit, venas nutrientes ad glandulas meſenterii tendere, ibique deſinere."—Galen appears not only to quote, but to admit Eraſiſtratus's experiments. —Haller ſays, "Hæc vaſa non tota prætervidit, fatetur certe in hædini meſenterii vaſis lac repereri."—Euſtachius is ſuppoſed by ſome to have delineated the lacteals in his tables; but I am here of Haller's opinion, who ſays that they are not lacteals, but arteries and veins, which are there repreſented. "Euſtachius lactea vaſa quidem non depinxit, etſi ita nuper repetitum eſt. Duplices enim & abruptæ lineæ, quas delineat rubra ſunt vaſa utriuſque generis, inter plicas meſenterii abſconſa."—Aſellius, however, was the firſt who diſcovered them to be a new ſpecies of veſſels, and who had any juſt idea of their office. Some anatomiſts have ſuppoſed that there were two ſpecies of abſorbents on the inteſtines, viz. lymphatics and lacteals; that the one abſorbed lymph, and the other chyle: but there is not the leaſt foundation for ſuch a diſtinction. The lacteals abſorb chyle from the inteſtines, when chyle is preſented to them; and at other times they abſorb other fluids. The lacteals alſo are divided into two ſets, viz. deep-ſeated and ſuperficial: the firſt of theſe I have uſually called *lactea exteriora*; the laſt of theſe, *lactea profundiora*. The deep-ſeated are covered by the muſcular coats of the inteſtines, accompany the arteries and veins, ramify exactly as they do, and are preciſely double their number; every artery and vein having an attendant lacteal upon each ſide, as will be ſeen in the annexed engraving. The ſuperficial ſet are immediately under the peritoneal coat of the inteſtine, and almoſt always run longitudinally on the gut. They may be conſidered as having the ſame connection with the deep-ſeated lacteals, that the cutaneous veins have with the deep-ſeated ones in the extremi-

ties; that is, they may be occaſionally traductory canals, and encreaſe the number of roads by which ſo important a fluid as the chyle may get into the blood. During the contracted ſtate of the muſcular fibres of the inteſtines, they are, perhaps, the principal conveyors of the chyle and lymyh. However cloſely the deep-ſeated lacteals accompany the arteries and veins on the inteſtines, they commonly leave them on the meſentery, and form as it were a number of ſeparate plexus. The manner of their entering and going out of the glands is exactly the ſame with that which I have formerly deſcribed in the abſorbents in general; nor does there appear to be any juſt foundation for the diſtinction *lactea primi*, and *ſecundi generis*, &c. of Winſlow.

The lacteals of the jejunum are much larger, and more numerous, than thoſe of the ilium, as the valvulæ conniventes, which are wanting in the ilium, encreaſe the internal ſurface of the jejunum to two or three times a greater extent than that of the ilium. The ſurface from whence they ariſe is not only larger; but, as the chyle, as ſoon as it is formed, is poured into this inteſtine, it appears to be the intention of nature, that a greater abſorption ſhould take place from this inteſtine, than from all the others taken together.

The lacteals on the meſentery paſs from one gland to another, till they form at laſt a large trunk, which accompanies the trunk of the ſuperior meſenteric artery till it comes to the right ſide of the aorta, at the origin of that artery; from whence it paſſes ſometimes almoſt immediately into the thoracic duct. I have known it more frequently inſerted lower than this place; and that, having left the ſuperior meſenteric artery, and run down on the right ſide of the aorta, it came to the place where the two trunks from the lower extremities were entering the duct, where it alſo aſſiſted in forming the thoracic duct, as will be more particularly mentioned by and by. Sometimes there are two trunks, ſometimes more. Thus they preſented themſelves alſo to Haller: "Vaſa lactea in majores truncos congeruntur; unicum in hædo, nonnunquam etiam in homine aut duos. Fræquentius aliquot quatorve aut circum eam numerum, etiam numeroſa vidi, in femina ſeptem vel octo. Vidi in puero anterius tria, quatorve cum arteria meſenterica ſecundum dextra orientis jejuni incedentia, plura vero poſteriora, minora."

"Tendunt autem cum arteria meſenterica, pone pancreas & duodenum primum, ad ſedem dexteriorem, ubi porro cum lymphaticis vaſculis conjunguntur,

conjunguntur, fere in confiniis ultimæ vertebræ dorſi, primæque lumborum."

I have ſeen the lacteals full of white chyle in the very beginning of the duodenum, and through its whole length. Morgagni ſaw them in the ſame ſtate, at the diſtance of three inches from the pylorus. Haller ſays they are by no means few in number: "Et vaſa quidem lactea a ventriculo non oriuntur, cæterum a toto inteſtinorum tractu; a duodeno minime pauca, naſci vidi, in animalibus aliis, in homine." As I had never ſeen any chyle in the abſorbents of the ſtomach; and as I conſidered the duodenum, from the opening of the gall duct and pancreatic duct into its cavity, to be a kind of ſecond ſtomach, even in the human ſubject, and that the chyle was not properly a nutritious fluid till it had paſſed through it; I believed that the chyle was never abſorbed till it began to enter the jejunum: but it certainly is; and the abſorbents of the duodenum are not inferior, in ſize or in number, to thoſe of an equal portion of the jejunum.

The ABSORBENTS of the GREAT INTESTINES.

THOSE from the cæcum, from the colon of the right ſide, and tranſverſe arch of the colon, join the trunks of the lacteals, formerly deſcribed, at or near the root of the meſentery; theſe may be called *lactea colica dextra:* whilſt thoſe belonging to the ſigmoid flexure of the colon form at laſt a trunk or trunks, which terminate in the lumbar glands, or, having paſſed their own glands, go immediately into the lower end of the thoracic duct itſelf. The abſorbents of the great inteſtines ſeem in proportion ſmaller than thoſe of the jejunum; and they really are ſo; but the difference is not ſo great as at firſt ſight may be ſuppoſed. Though we call them great inteſtines, on account of their larger diameter, yet the jejunum, from the valvulæ conniventes on its internal ſurface, forms a tube in reality three times longer than it appears; and there is more ſubſtance in a foot of it, perhaps, than in the ſame quantity of the colon. The chief abſorption of the chyle being from the jejunum, is another reaſon why its abſorbents are larger. The great inteſtines, however, are ſaid ſometimes alſo to contain chyle. Winſlow demonſtrated this to the

Academy

Academy of Sciences: "On la peut établir en général par les veines lactées des gros intestins: j'en ai démontré plusieurs très-visiblement & très-distinctement a l'Académie Royale des Sciences, dans le colon de l'homme, & toutes pleines de chyle. Feu M. Mery de la même Académie, qui étoit toujours très-difficile sur les observations d'autrui, étant alors présent, & ayant vu qu'avec le bout de mon doigt je poussois uniformément d'espace en espace dans ces vaisseaux du colon la liqueur blanche qu'ils contenoient, en parut d'abord assez content; mais pour s'en assurer davantage, il me fit en même temps, & en sa présence, ouvrir un de ces vaisseux avec la pointe d'une lancette, en tirer un goutte de la liqueur, & la mettre sur l'ongle de mon pouce; ce qui le contenta entierement." Haller also asserts this.—I have never seen it.

I by no means assert, that the absorbents of the great intestines do not absorb something from their contents, as well as those of the small intestines; though I have seen the solid fæces in the beginning of the colon. The fæces are, however, certainly harder in the rectum than in any other part of the great intestine, and particularly so in costive habits of body, where they have remained for a long time. Copious and nutritious glysters have been given by the rectum, which never have returned in that form. Though I have said, that I knew of no case where patients had been nourished by glysters longer than three weeks, there are cases on record of their having supported the body for forty days, or even three months. Glysters of turpentine give the urine the smell of violets; and the Peruvian bark has cured fever, exhibited in the form of glyster, when the stomach would not retain it. "Vis corticis Peruviani, quam credas in terra esse, tamen per glysteres ad sanguinem penetrat, febresque tollit, eoque eventu Andrianus Helvetius plurimos imprimos pueros sanavit." Haller.—The Peruvian bark may, however, cure the fever without being absorbed.

Though very little chyle was to be absorbed from the great intestines, the absorbents became necessary to remove the fluids of surfaces and cells. The solid parts of these intestines are also sometimes removed; and, besides these purposes, as I have just now observed, the absorbents here are intended occasionally to take up nutritious fluids, or even medicines themselves thrown into these cavities, by the invention of men, in situations when they could not be applied to the usual surfaces.

The

The THORACIC DUCT.

HAVING pointed out the principal veſſels, by the union of which the thoracic duct is formed at its beginning, I ſhall take an opportunity here of deſcribing more particularly this principal trunk of the abſorbent ſyſtem; after which I ſhall return to the deſcription of the other veſſels which enter it, through its courſe along the ſpine, toward the left ſubclavian vein. I muſt take notice alſo of a ſecond, but ſhorter and inferior trunk, which terminates in the right ſubclavian vein.

The name thoracic duct, firſt uſed by Tho. Bartholin, appears to be extremely improper, as it by no means conveys the idea of the principal trunk of the abſorbent ſyſtem. Boerhaave compared it with the cava inferior; in which reſpect it might be conſidered as a cava minor. There is alſo ſome analogy between the ſecond trunk of the abſorbents and the cava ſuperior.

The firſt diſcoverers of the thoracic duct deſcribed it as beginning by a pyriform bag, to which they gave the name of the receptacle, or the ciſtern of the chyle. In quadrupeds, particularly in dogs, it actually ariſes out of a large cavity, in which the lacteals terminate, and pour out the chyle. "In brutis animalibus pleriſque chyli ciſterna reperitur, ut in cane, in quo primum eſt inventa; in lupo, leone, urſo, phoca, ſue, erinaceo, bove, capella, cervo, equo." In theſe animals, "Ampulla chylifera inſignis ſedet, multo omni ductus thoracici diametro latior, ovalis & longior, in quam confluunt, hæc, quæ diximus, vaſa lactea ſuper venam renalem, et ductus lymphatici magni lumbales & hepatici." Haller.—This deſcription by no means agrees with what we commonly find in the human thoracic duct. I do not ſay that a receptacle of the chyle never exiſts in the human body. I have ſeen it ſometimes; but much more frequently there is none. Haller ſays, "Neque in hominem nunquam ea fabrica reperitur; etſi nuperiores ſcriptores ciſternam ſolent exagitare. Sexies certe inter 21 cadavera humana, in quibus ductum thoracicum oſtendi, ampullam vidi." At any rate, the name of receptacle of the chyle is improper, as it conveys an idea that the thoracic duct received nothing elſe than chyle; which its firſt

diſcoverers, as they knew nothing of the lymphatics, really believed was the caſe; but as we now know that this trunk of the ſyſtem receives the lymph oftener, and in greater quantity, than it does the chyle, and as the lacteals are ſeldom inſerted into it, even when it is found, I ſhall avoid the term.

The thoracic duct begins much lower down than has commonly been imagined, and is ſituated at firſt on the third vertebra of the loins, on the left ſide of the ſpine, inſtead of on the firſt vertebra of the loins, and on the right ſide of the ſpine, as has been aſſerted. I have commonly injected it from the glands of the groin, on both ſides, and by this means have ſeen its origin more diſtinctly. Haller's method was by no means ſo proper. He ſays, "Si ſolum ductum thoracicum demonſtrare volueris res nullius eſt difficultatis—Inquires enim vel in vas lymphaticum aliquod ante ſiniſtram venam renalem adrepens qualia nunquam non adſunt, vel in vas lumbale ad latus aortæ ſub renali dextra arteria & vena latens." We have no opportunity, as in quadrupeds, of making ligatures in the living body, on the upper end of the thoracic duct, and ſeeing it fill itſelf with chyle.

The thoracic duct begins by the union of three trunks, as I formerly obſerved; one of theſe is the trunk of the abſorbents of the right leg, the ſecond is the trunk of the abſorbents of the left leg, and the third is very commonly the trunk of the lacteals; theſe, by their union, ſometimes form a globular cavity, half an inch in diameter, lying on the ſecond vertebra of the loins. At other times, the three trunks lie parallel to each other for an inch or two, before they unite; during which period they are wrapt up in the ſame covering of the cellular membrane; and, when cut acroſs, without diſſection, have put on the appearance deſcribed by ſome, "Cavitatem veram trilocularem." After they unite, the duct becomes ſmaller. During this courſe it is under the aorta, and croſſes obliquely from the left to the right ſide of the lumbar vertebræ, where it enlarges again, and ſometimes forms a pyriform bag, on the uppermoſt vertebra of the loins, which has commonly been ſaid to be the beginning of the duct.

Haller's deſcription is ſomewhat different from mine: "Oritur in meis experimentis ex trunco lymphaticorum lumbalium, incipit intumeſcere ad arteriæ ſpermaticæ initium tenet angulum inter vertebram

bram primam lumborum & appendicem diaphragmatis intimam ad dextra arteriæ aortæ & pone omnia, vaſa renalia a ſecunda vertebra lumborum ad primam dorſi."

At the uppermoſt vertebra of the loins, the thoracic duct lies under the right crus of the diaphragm. Haller ſuppoſes, that this muſcle, in contracting, comes nearer the bodies of the vertebræ; and therefore, in every contraction, compreſſes the receptaculum chyli, and in every relaxation leaves it free: that in the one ſtate the chyle muſt be drove on, and in the other ſtate the chyle has room to enter. This he compares to the ſyſtole and diaſtole of the heart: "Dum inſpiramus, tumere appendicem diaphragmatis, quæ ciſternam protegit, eamque excutere & inanire, uti œſophagum comprimit; ſic motum in chylo orire:"—and, to reverſe his expreſſion, afterwards, "Erit tempus ſyſtoles ejus ductus." On the contrary, when the diaphragm relaxes, and its crura become flaccid, the receptacle of the chyle will be filled, as the trunks of the lacteals will then throw their fluid into a cavity where they meet with the leaſt reſiſtance. This ſtate of the diaphragm he compares with the diaſtole of the heart: "In expiratione——remittit ſe diaphragma et ejus appendices detumeſcunt. Replebitur adeo ciſterna a chylo, quem vaſa lactea eo, tamquam in locum minus reſiſtentem, ſubmittunt, erit diaſtole ciſternæ." He ſuppoſes a ſimilar effect from the alternate ſtates of compreſſion and relaxation, which the contents of the thorax undergo in reſpiration: "Nunc certum eſt, per numeroſiſſima experimenta, alterne in toto thorace preſſionem minui, laxari omnia, inque amplius ſubnatum ſpatium ſe liberius diffundere, ut etiam expulſi pulmones in pectus quaſi reſorbeantur; & viciſſim in expirationem comprimi, etiam vehementer, atque totam pulmonem de vulnere expelli." I believe that the crura of the diaphragm have very little contraction or relaxation, except on extraordinary occaſions, as in ſighing, yawning, coughing, and ſtraining of every kind; for on thoſe occaſions I have frequently found them pulling the centrum tendinoſum downwards, diſturbing the motion of the heart, and giving pain in that region; and I ſhould rather ſuſpect that, on theſe occaſions, they receded from the body of the firſt vertebra of the loins, than that they came nearer to it; but I am not certain. Haller himſelf, in another part, makes all this extremely doubtful; for he ſays, "Etſi enim preſſionem muſculorum abdominis

aliquid in pleniſſimo abdomine poſſit, in ciſternam potiſſimum tamen experimenta docent, chylum iis muſculis reſectis, a morte celeriter moveri." The fluids alſo continue to flow through the thoracic duct, after the thorax is opened, and when every effect of alternate compreſſion and relaxation muſt of courſe have been removed.

About the firſt vertebra of the loins, the thoracic duct getting above the diaphragm, lies on the right ſide of the anterior ſurface of the ſpine, between the vena azygos of the right ſide, and the aorta of the left, and thus as high as the upper edge of the arch of the aorta. If it be double, one of the ducts lie under the aorta commonly; and even when it is not double, very large veſſels belonging to it lie under the aorta, and muſt receive its pulſe in its diaſtole. It is even probable, that in the greater part of its courſe through the thorax, though the thoracic duct does not lie under the aorta, yet, as it lies upon its right ſide, the fluids of the one may receive ſome impetus from the diſtenſion of the other. Haller attributes much of the motion of abſorbed fluids to this pulſe of the aorta; ſo that he even thinks it probable, that the reaſon why the thoracic duct, which below the arch of the aorta lay upon the right ſide of the ſpine, and of courſe nearer the right ſubclavian vein, croſſes under the arch of the aorta, and paſſes to the left ſide, to terminate in the left ſubclavian vein, is, that its fluids may receive a ſtronger momentum from the dilated arch of the aorta, where the force of the blood is ſtronger than any where elſe. This he thinks is farther confirmed from this circumſtance, that where the viſcera have been tranſpoſed, and the aorta has gone down on the right ſide of the ſpine, inſtead of the left, and the thoracic duct, alſo tranſpoſed, lay upon its left ſide, it ſtill croſſed under the arch of the aorta, and was then inſerted into the right ſubclavian vein. "Suſpiceris, ut eam preſſionem potentiorem experiatur, ad ſiniſtram axillarem venam, pone aortæ arcum chyliferum ductum traduci, qui propior fuiſſet dextræ ſubclaviæ: adeo certe conſtante naturæ fine, ut cum omnia viſcera tranſpoſiti forent, is ductus in dextram pariter ſubclaviam inſereretur."—The pulſe of the aorta may be a powerful aſſiſtant in driving on the abſorbed fluids through the thoracic duct, and the pulſe of arteries in general may be of the ſame utility to its branches, in propelling their fluids; but the principal force propelling the abſorbed fluids, is to be attributed to the muſcular powers of the abſorbent veſſels

themſelves. For the abſorbents very often forſake the arteries, and go by themſelves, as we ſee on the meſenteries of quadrupeds, and in their accompanying the cutaneous veins in animals in general, from which they can receive no propelling impulſe. One reaſon why the thoracic duct goes to be inſerted into the left ſubclavian, in preference to the right, I have already given, viz. that its fluids might receive leſs reſiſtance from the ſtagnation, or even retrograde motion, of the blood in the cava ſuperior and its great branches, that take place on the contraction of the right auricle. The angle of the right ſubclavian, or, properly ſpeaking, the right jugular vein, is in a direct line with the cava ſuperior, whilſt the left jugular is at right angles with the ſubclavian, and this laſt forms an obtuſe angle with the cava ſuperior; and therefore the reſiſtance in the right ſide is greater, to the entrance of the abſorbed fluids, than in the left.—But I return to the deſcription of the thoracic duct.—Having emerged above the diaphragm, it gradually becomes ſmaller, until it comes near the middle of the back, where it is frequently not much more than a line in diameter; after this, it gradually enlarges, and near its termination may be about three lines in diameter: I have ſaid that it was frequently five lines in diameter at its origin. When injected through its whole length, it appears to run ſerpentine; but this may be a deception: arteries that were formerly ſtraight, become ſerpentine on being very much diſtended, as we ſee in the arteries on the outſide of the head, in old men, which being nearer the heart, in proportion, than moſt other arteries, are more dilated, and more ſerpentine. We ſee the ſame thing alſo in the collateral anaſtomiſing branches of the brachial artery, round the joint of the fore-arm, and arm, after the operation for the falſe aneuriſm, from bleeding at that place, has been performed; theſe arteries in general are ſtraight; but, after the operation for the aneuriſm, become exceedingly ſerpentine. The thoracic duct, however, without being injected, is ſomewhat ſerpentine. Haller ſays, "Per thoracem adſcendit, paulum ſerpentinus, tamen ut pene rectus adſcendat."

In the incurvations of the ſpine, the thoracic duct, as tied to it by its branches, by thoſe of the azygos, and by cellular membrane, muſt make the ſame windings and angles that the ſpine happens to make; and as fluids, if the projectile force is the ſame, will move with greater velocity through a ſtraight than a curved tube, the force with which the abſorbed

ſorbed fluids of the thoracic duct overcome the reſiſtance to their entrance into the veins, made by the blood in them, muſt be diminiſhed in ſuch bodies; but whether this diminution of force is attended with any material bad conſequence, I do not know. I have ſeen a trunk of the abſorbents of the lungs convoluted at leaſt a thouſand times before it entered the duct, and I have even ſeen ſimilar convolutions in parts of the duct itſelf. A great deal of power appears to be loſt, by the conſtruction of animals, in many of their parts; but this loſs appears not to be attended to, when an adequate advantage is procured in ſome other way.

About the ſixth or ſeventh, or more frequently the eighth, vertebra of the back, the thoracic duct ſplits into two, and then unites again; this is what Haller calls *inſulam efficiens*; ſometimes it ſplits into ſeveral branches, which again unite, as in the former example; ſometimes it forms a number of theſe iſlands, and ſometimes it forms none. Having paſſed the arch of the aorta, the thoracic duct croſſes, as I have ſaid, from the right ſide of the ſpine to the left, and when full, or injected with a coloured fluid, may be ſeen on the left of the œſophagus diſtinctly, through the pleura, without any other diſſection than that of opening the cheſt, and turning forward the lungs. After this, the thoracic duct, emerging from the cavity of the cheſt, gets above the pleura, and lies upon the muſcle longus colli, and behind the arteria thyroidea inferior; at this place it enlarges conſiderably, and, though its deſtination is the angle of the ſubclavian and jugular veins, it paſſes by that angle, forms a conſiderable curve, and deſcends to its termination; I formerly ſuppoſed, with a view to give its fluids the advantage of their own gravity in overcoming the reſiſtance made to their entering the veins; but it is much more probable that this curve is formed to give room for the inſertion of a number of large trunks, which join it juſt before its entrance into the veins. It ſometimes, though rarely, happens, that the thoracic duct does not paſs by the angle of the jugular and ſubclavian, but aſcends to its termination. Haller ſays, "In venam ſuam aſcenderit neque ſurgerit, ſupra ſubclavios truncos—id ſemel puto in homine vidi aut bis, vidit etiam accuratiſſimus Caſſebohmius." Before its inſertion, and whilſt it is behind the jugular vein, it commonly ſplits into two, three, or more branches; theſe, for the moſt part, unite again, and the duct terminates in the veins as a ſingle trunk: ſometimes they form two or three ſeparate terminations;

terminations; these terminations are sometimes in the jugular vein above the angle, more commonly in the subclavian vein, on the left side of the angle. Haller says, "Rarum enim, si ductus thoracicus in siniſtram subclaviam, quidem sed multifidus & plusquam duobis ramis, tribusve, et pluribus, sui finem fecit, vidi tamen & in homine." In the human subject there are constantly a pair of valves at the entrance of the thoracic duct into the subclavian vein; these, on certain occasions, shut up the duct, and prevent the venous blood from flowing into it. Haller, speaking of this valve, says, "Officium valvulæ habere clariſſimi viri censent, ut chylum in venam admittat in ductum nequaquam. Ad id munus mihi vix sufficere videtur." He says also, of the other valves of this duct, "Raræ tamen sunt in homine, ut exstent, qui negant earum numerum superare duodecim, parumque conspicuæ, ut etiam officio suo non valde accurate fungantur, nec totum lumen ductus thoracici claudant, chylumque relabi ceramque retrorsum descendere permittant." For my own part, I know no other use they can serve, than that of preventing the retrograde motion of the chyle, or hindering the blood in the veins from passing down the duct. The valves allowing injection to escape in the dead body, proves nothing, as many circumstances are wanting which existed in the living body; however, in the dead body, so well do the valves at the orifice of the thoracic duct perform their function, that it is exceeding rare indeed to find the injection passing from the vein into the thoracic duct. I admit that the valves can be of no use, except on certain occasions; and that, as the fluids in the thoracic duct are generally able to overcome the resistance of the venous blood to their entrance into the veins, this alone prevents the blood from passing into the duct, and the valves are not called into action: but there are two occasions in which I have no doubt that these valves are wanted:—The first is, in straining and coughing, and other violent efforts, the blood of the subclavian and jugular veins is prevented from passing into the heart, of course distends the sides of those vessels with uncommon force, such as the absorbed fluids would not be capable of overcoming; the venous blood would then descend into the thoracic duct, did not these valves prevent it: the motion of the chyle would also, at that time, become retrograde, did not the other valves prevent this. There is also another occasion on which it appears to me more than probable that the valves are called into action:—Doctor Hunter suspected that the chyle

chyle went into the blood, at the angles between the jugulars and ſubclavians, drop by drop, and that it was conſtantly doing ſo. From what I have ſeen, in opening living or recently dead animals, I am perſuaded that it muſt be otherwiſe; for there are only particular periods when the chyle is poured into the inteſtines, at which periods only it can be abſorbed. I have alſo ſeen very large quantities of chyle in the ſubclavians, vena cava ſuperior, and right auricle of the heart, floating as it were upon the ſurface of the blood, and perfectly white; at other times the mixture of red and white was ſo uniform, that there muſt have been at leaſt as much chyle in theſe cavities as there was blood. From theſe facts it muſt follow, that the chyle is poured into the veins in full ſtream, and that there are periods when the abſorbed fluids are thrown into the veins in greater quantity, and with greater force. I am even certain, that the abſorbing powers are frequently quieſcent; and that, upon all theſe occaſions, the valves will be called into action, to prevent the blood of the veins from paſſing into the duct.

The thoracic duct is ſometimes double through its whole length: there is a preparation of this kind in the collection in Windmill-ſtreet, which I injected many years ago with quickſilver; one of theſe thoracic ducts is inſerted into the right ſubclavian vein, and the other into the left. I have alſo ſometimes ſeen it triple, or nearly ſo. Sometimes the thoracic duct is inſerted into the right ſubclavian vein, inſtead of the left, and then the trunk of the abſorbents of the left ſide, in every reſpect, reſembles the ordinary appearance of that of the right ſide. There is alſo a preparation of this kind in the collection at Windmill-ſtreet, which I injected from the umbilical vein in a child at birth; the injection was melted tallow, ſoftened with ſome turpentine, and coloured with vermilion: the injection got into the thoracic duct, which was diſtended with a white injection through its whole length, and was inſerted into the right ſubclavian; the colour had been dropt by the way, as we have frequently ſeen it when a ſimilar injection has paſſed from the extremities of arteries into the beginning of veins, and which is a proof of its having paſſed through extremely fine tubes. The ſame thing I find had happened to Haller and Mekel. Haller ſays, "Ductus thoracicus per arterias aliquando ſe repleri paſſus eſt oleo potiſſimum terebinthinæ rubro. Solet vero id oleum colorem deponere." I ſuſpect here, that the injection paſſed into the mouths of the lymphatic vaſa

vaſa vaſorum, which ariſe from the internal ſurfaces of the arteries and veins.

It has ſometimes happened that I have injected the branches of the thoracic duct from the trunk, contrary to the valves, ſo as almoſt to cover the ſpine with lymphatics, and to inject thoſe of the intercoſtal ſpaces themſelves; ſo that our common injections of that duct, which do not paſs the valves, give no adequate idea of this trunk of the abſorbent ſyſtem, as they repreſent it without any branches.

The Trunk of the ABSORBENTS of the RIGHT SIDE.

HAVING deſcribed the thoracic duct, or the principal trunk of the abſorbents, which is inſerted into the angle of the left jugular and ſubclavian veins, we cannot, with propriety, omit taking notice of the other trunk, which is inſerted into the angle of the right ſubclavian and jugular. The length of the thoracic duct is from ſixteen to eighteen or twenty inches, for this varies in proportion to the height of the body. Its diameter, juſt before it terminates, I have ſaid, is from two to three lines. The trunk of the abſorbents of the right ſide is commonly not more than a quarter or half an inch in length; and its diameter, near its termination, very nearly the ſame with that of the thoracic duct at the ſame place. It belongs to the abſorbents of the right lobe of the liver, right ſide of the diaphragm, right ſide of the heart, right lobe of the lungs, right arm, right ſide of the head, and right lobe of the thyroide gland. When the thoracic duct happens to be inſerted in the right ſubclavian vein, the trunk in the left ſide, in every reſpect, reſembles that of the right, as I have already ſaid. The termination of lymphatics in the right ſubclavian vein, appears to me to be the diſcovery of Steno, the pupil of Thomas Bartholin. It was made in quadrupeds, but it was very eaſy to transfer it to the human ſubject. Haller ſays, "Ita Nicolaus Steno ex dextro capitis latere, dextro pede anteriori & dextra pectoris cavea, vaſa lymphatica in venas axillares deduxit." Ruyſch alſo aſſerts, that the lymphatic veſſels of the lungs terminated in the ſubclavian veins. Haller ſays, "In pectore "vaſa lymphatica pulmonis in venas ſubclavias etaxillares ire, non facile in mera rerum hiſtoria rejiciendus auctor teſtatur Fredericus Ruyſch."—

Another

Another part of this termination was alſo diſcovered by Nuck.—The ſame author ſays, " A ſpatiis intercoſtalibus venas pellucidas in jugulares truncos derivavit Nuckius, tum a diaphragmate in eaſdem venas, a corde iterum in eas, & in ſubclavias." Mr. Hewſon, however, appears to have been the firſt who diſtinctly made out this trunk; for the other anatomiſts, though they knew the termination in the right ſubclavian, conſtantly deſcribed them as numerous, not forming a common trunk. Though Haller quotes Mr. Hewſon, reſpecting theſe terminations, he does not ſay whether he made it a ſingle termination, or a number of terminations. He ſays, " Numeroſa etiam vaſa aquoſa, ſunt thyreoideæ glandulæ. Hæc omnia in trunculos unita, cum ramis a capite deſcendentibus & comitibus ramorum arteriæ carotidis, demum in dextro latere cum vaſis pulmonis & thyreoideæ, dextra quidem in angulum venæ ſubclaviæ cum jugulari, ſiniſtra vero & in ductum thoracicum ſe immittunt, & in ſubclaviam, iterum Hewſono auctore."—Mr. Hewſon's words are, " The lymphatic veſſels of the right ſide form four conſiderable trunks, which join near their termination. Theſe trunks are, firſt, one from the upper extremity; ſecondly, the trunk of the lymphatic veſſels of the right ſide of the head and neck; thirdly, a lymphatic from the thyroide gland; fourthly, the trunk of the lymphatics from the fore part of the lungs of the right ſide." He has here omitted the lymphatics from the right ſide of the heart, as well as thoſe from the liver and diaphragm, and the veſſels accompanying the internal mammary arteries. Indeed it frequently happens, that there are more inſertions than one in both ſubclavians; and, though the inſertions into the angles between theſe and the jugulars appear to be the moſt accurate, yet it does not ſeem to be of that conſequence as not to admit of ſome little deviation; accordingly, we find inſertions ſometimes in the jugulars, a little above the angles, ſometimes in the ſubclavians, a little to the outſide of the angles.

We return now to the cavity of the abdomen.

The ABSORBENTS of the OMENTUM.

THESE are in three diviſions, like its arteries and veins; and the larger trunks are found with the arteries epiploica dextra, epiploica media, and epiploica ſiniſtra. They commonly paſs into glands between the

the ſuperior edge of the omentum and the inferior edge of the ſtomach. Having paſſed through theſe glands, they blend with the abſorbents of the ſtomach. Theſe glands are not always found, and when they are found, are commonly very ſmall. Haller has noticed theſe glands, but ſeems to have known very little of the abſorbents. "Glandulas," ſays he, "in nullo omentorum vidi, præter eas quæ arcum majorem ventriculi ſequuntur, & quæ minorem; eaſque quæ ad portas hepatis adſident; ſed eæ ad omenta pertinent.—Lymphatica vaſa, qui ipſi forte Biumi ſunt canaliculi, poſſunt circa glandulas conglobatas fuiſſe."

The ABSORBENTS of the STOMACH.

I formerly mentioned a paſſage in Hippocrates, where it is ſaid, Εισι απο της κοιλης φλεβες—δι ὧν ἡ τροφη εν τω σωματι ερχεται. — "There are veins which come from the ſtomach, by whoſe means the food comes into the body." I then ſaid thoſe veins were imaginary, that the lymphatics of the human ſtomach were not eaſily found, and that they never carried a white fluid, like the lacteals. In oppoſition to this aſſertion of mine, I find a treatiſe by Biumi, an Italian anatomiſt, publiſhed at Milan in 1728, entitled "Eſamine d'alcuni canaletti chiliferi chi del fondo del ventriculo per le tonache dell' omento ſembrano penetrar nel Fegato."—That is, "An examination of certain veſſels carrying chyle from the cavity of the ſtomach, which, paſſing along the coats of the omentum, appear to penetrate into the liver." I have not ſeen the book; but I underſtand from Haller, that this pretended diſcovery was made in dogs; that the trunk of thoſe veſſels was as large as a gooſe-quill, and that it divided into ſmaller branches, which ramified through the liver; that when opened, the chyle flowed out; that the author aſſerted, it was by means of thoſe veſſels that medicines got by a ſhorter road into the blood, and the food itſelf, in ſtrictures of the pylorus, when it could not poſſibly get into the inteſtines. "Vaſa chylifera fuiſſe, diſſectis chylum dimiſiſſe, & candore ſuo conſpicua fuiſſe, ea eſſe vaſcula quæ brevi via, aquæ acidulæ, ad ſanguinem veniant; & ob eam cauſam ſupervivere, quibus ob clauſum ventriculi exitum, nihil ad inteſtina, neque ad vulgata vaſcula lactea venit." Haller alſo ſays, "Deinde Broggius & Bellus viderant vaſa alba in animalibus de tota ventriculi longitudine orta, conjuncta in truncum, valvuloſum, tendentem ad hepar, per id viſcus diſ-

tributum, a lymphaticis vaſis diverſum, ſolum vehentem chylum." I ſhould hardly have noticed theſe experiments, if Haller had not ſhewn ſome diſpoſition to believe them. His comment, in his Bibliotheca Anatomica, on them, is, "Experimenta nimis pauca." Some of the lacteals anaſtomoſe with the lymphatics of the liver and diaphragm, as I have already ſhewn; and it is equally poſſible, if the abſorbents of the great inteſtines tranſmit chyle, that ſome of thoſe belonging to the tranſverſe arch of the colon may anaſtomoſe with the abſorbents of the ſtomach, and that the chyle might thus be ſeen in them, and might take the road they have deſcribed. But I never ſaw this; even when I have ſeen the chyle in the lacteals of the duodenum, I never ſaw any on the pylorus, or any part of the ſtomach. The ſudden reſtoration of vigour, in languors and want of food, that takes place on throwing nouriſhing fluids or ſolids into the ſtomach, depends on another circumſtance. The watery part of the food may be abſorbed from the ſtomach, and thrown off by the kidnies; but it is the chyle only which nouriſhes. Now it requires ſome hours before the chyle is formed; and it is not perfect till it has received the bile and pancreatic juice in the duodenum, after it has quitted the ſtomach, as we ſee from the derangement and debility which take place when any cauſe prevents the union of theſe fluids with the chyle in the duodenum. The reſtoration of vigour is certainly from the effect theſe ſtimulating, as well as nutritious ſubſtances, thrown into the ſtomach, have on its nerves; and one might as well contend, that when ſpirit of ſal ammoniac was held to the noſe, and recovered a perſon from a fainting fit, or prevented one, that ſomething was abſorbed from it and carried into the blood. It is not true. It produces its effects inſtantly, and only in proportion to its ſtrength, and great ſtimulus on the extremities of nerves immediately almoſt connected with the brain, and which are leſs covered than any other nerves in the body. Haller does not admit thoſe chyliferous veſſels of the ſtomach, only becauſe they have not been ſeen by later anatomiſts. "Verum alba quidem in ventriculo vaſa nuperior induſtria non reperit, neque admiſerunt viri in vivis animalibus incidendis plurimum experti." Amongſt thoſe he mentions Bruner and Pauli. I have admitted the poſſibility of the appearance, though I have never ſeen any thing like it myſelf; and have endeavoured to account for it in a different way.

Veſlingius had before this deſcribed lacteals on the ſtomach, "Vaſa lactea in ventriculo," but the anatomiſts, at that period, called every veſſel that reſembled lacteals in the tranſparency of their coats and number of valves, lacteals. Veſlingius ſays, ſometimes, "Lacteorum æmulos vidi." Though I have not ſeen chyle in the abſorbents of the ſtomach, I have often ſeen the lymph, and very often injected thoſe veſſels, not only in the human ſubject, but in a variety of animals; in an elephant, in horſes, in aſſes, in the turtle, and in ſkate. In the turtle I have puſhed the injection to the internal ſurface of the ſtomach, and ſeen it in veſſels juſt viſible to the naked eye.

The abſorbents of the ſtomach form three principal diviſions; one ſet accompany the branches of the coronary artery and vein, they run from the anterior and poſterior ſurfaces of the ſtomach towards the ſmall arch, and I have uſually diſtinguiſhed them by the name of *coronaria ventriculi*. They alſo are double the number of the arteries and veins, and run, like the lacteals, on their outſides, having an artery and vein between them; they alſo conſiſt of a deep-ſeated and ſuperficial ſet; they run towards four, five, or ſix glands, ſometimes ſituated on the ſmall arch of the ſtomach itſelf, ſometimes between it and the little epiploon of Winſlow. Having entered theſe glands, they paſs out in larger trunks, which commonly paſs into the ſame glands, behind the duodenum, which the deep-ſeated abſorbents of the liver enter, and with them paſs into the thoracic duct, on the right ſide of the aorta, near the origin of the cæliac artery. Sometimes I have ſeen them run upwards, towards the cardia, and paſs into the thoracic duct behind it. A preparation of this kind I had many years ago in Windmill-ſtreet. I removed the ſtomach, with a part of the thoracic duct behind it, and put it in ſpirits. The abſorbents were ſeen running from the ſmall arch into the thoracic duct, which was turgid with the quickſilver it had received from them. Haller appears to have ſeen theſe veſſels: he ſays, "Cum in ſuperiori arcu ventriculi & in majori glandulæ conglobatæ ſint, in ventriculo etiam vaſa lymphatica merito exſpectes, in arcu certe minori vidi quam maxima tendentia in ductum thoracicum." The next diviſion, is that from the middle of the great curvature of the ſtomach; it is joined by the abſorbents epiploica media and ſiniſtra of the omentum; and, running with the artery named gaſtrica ſiniſtra, paſſes upwards, and to the left, to-

wards the great end of the ſtomach, where it blends with the abſorbents of the ſpleen and pancreas, and goes with them into the thoracic duct. They may be termed *gaſtrica ſiniſtra*. The third diviſion ariſes alſo about the middle of the great curvature of the ſtomach, runs with the artery named gaſtrica dextra, towards the pylorus, receives in its way the abſorbents epiploica dextra of the omentum, and, blending alſo with the deep-ſeated abſorbents of the liver, behind the duodenum, enters the ſame glands, and paſſes with them into the thoracic duct. Haller appears to have ſeen theſe only in the quadruped, for he ſays, "Et ego in cane vaſa lymphatica ab omento in ventriculum venientia vidi, qua ſede eorum erant trunculi." Theſe may be named *gaſtrica dextra*.

Of the inorganic pores of ſome anatomiſts, ſuppoſed to exiſt in the ſtomach, I know nothing, and believe as little. By thoſe they mean pores penetrating its ſolid ſubſtance, but not belonging to any veſſels. "Non hic poros volumus qui in venas ex ventriculi cavea pateant, ſed poros qui per ipſam naturam ſolidam partium ventriculi faciant ſibi viam. By theſe pores they endeavoured to explain the quick return, by urine, of mineral waters, when taken into the ſtomach; the ſometimes ſudden cure of dropſy of the abdomen, by vomiting or purging. Haller here ſeems to doubt; and even furniſhes me with arguments againſt himſelf, in another part of his work, having firſt ſaid, that it might be ſo. "Mihi res videtur ſimpliciſſima. Cutis ipſa abſque illa de truncis reſectis ſuſpicione, & corium, niſi craſſiſſimum fuerit, aquam & potiſſimum calidam tranſmittet. Et bilis manifeſto per vias non vaſculoſas in exteriorem faciem veſiculæ penetrat. Utique ergo ut in aliis corporibus, ita in nervea ventriculi & in peritonæo, pori ſunt inorganici quos aqua penetrare idonea eſt." I have already proved that there is no ſuch tranſudation in the living body; and Haller, notwithſtanding the foregoing ſentences, adds, "Num ideo in vivo animale humor per eos poros vere penetret, poſſit dubitari. Oſtenditur veſicam urinariam pleniſſimam repertam eſſe abſque ulla lotii in abdomine effuſione, cum exitus urinæ per ureterem interceptus eſſet. Ventriculus, ob clauſum pylorum cibis & potui impervius, extenditur in immenſam molem indicio potum non adeo facilem viam reperire per quam effugiat, in aquam hydropicam potus ſe non admiſcet quæ coagulabilis ſit indolis quale nihil bibimus, & in

& in ſano homine etſi plurimum bibit præter vaporem nihil eſt in abdomine. Cum cæruleo pigmento ventriculum vivi canis replerem, tinxit vaſa lactea; cæterum in abdomine is color non exiit, neque ſe ut fuerat neceſſe ſuo colore extulit."

The ABSORBENTS of the SPLEEN.

THESE are of two ſets, a deep-ſeated and ſuperficial. The laſt run upon the ſurface of the organ, between the peritoneum and its proper coat; theſe are with great difficulty ſeen in the human ſubject, but, in quadrupeds, particularly in calves, are more numerous than perhaps on the ſurface of any viſcus in any other animal. In the human ſubject, they run on the convex ſide of the ſpleen, towards the concave edge, where its arteries are entering in; they there join the deep-ſeated ſet. Theſe laſt, as in the kidney, accompany the veins through the ſubſtance of the ſpleen; they are eaſily ſhewn, by making ligatures on the ſplenic artery and vein as they come out of the ſpleen, and gently kneading its tender ſubſtance between the thumb and fingers: the blood, which had tranſuded into the cellular membrane, is thus forced into the abſorbents, and they become viſible. Haller ſays, "Sic olim F. Ruyſchius, ligata vena lienali, & contrectato viſcere, vaſa lymphatica demonſtrabat." The abſorbents of the ſpleen, ſoon after they emerge from its ſubſtance, paſs into glands which lie upon the ſplenic artery, and which are ſcattered at little diſtances from one another through the whole courſe of that veſſel. In their courſe through theſe glands they receive the abſorbents of the pancreas, and, having blended with thoſe from the ſtomach, and ſome from the liver, near the head of the pancreas, they paſs with them into the thoracic duct.—Haller does not ſay that he has ſeen theſe himſelf, but, quoting Malpighi, ſays, "Secundum totam arteriam ſplenicam, ad ſinum uſque lienis glandulæ conglobatæ abundant, quas adeunt."—Again, "In homine rara eſt memoria; ſubinde unum alterumve ſe vidiſſe in poſthumis Caſſebohmius, pauciora eſſe Ruyſchius fatetur, & Nuckius, & Winſlow."—Since this treatiſe went to the preſs, I have had an opportunity of ſeeing them larger, and in greater numbers, than on any former occaſion.

The

The ABSORBENTS of the PANCREAS.

HALLER ſays, he does not know whether the pancreas has lymphatics or not. The anatomiſts who ſucceeded Aſellius ſpeak of them frequently. "But then," ſays he, "it is not the true pancreas which they mean, but the ſpurious one of Aſellius, or the conglomeration of the lymphatic glands, at the root of the meſentery, in dogs." His words are, "Num pancreas lymphatica vaſa habeat? ignoro, & dubito. Quæ adeo frequenter apud ſeculi prioris ſcriptores nominantur, ea fere ad ſpurium illud Aſellii pancreas pertinent."—Aſellius mentions the true pancreas as glandula ignota; and Mr. Hewſon ſays, "The lymphatic veſſels of the ſpleen paſs from the concave ſide of that viſcus, along with the ſplenic artery, in the ſinuoſity of the pancreas, by the lymphatic veſſels of which they probably are joined."

That the pancreas has abſorbents, I am well aſſured. I have ſeen them, on a great many occaſions, riſing out of the pancreas, and joining the ſplenic plexus, already deſcribed. They ſeem to have been firſt diſcovered by Veſlingius; and he expreſſes himſelf in ſuch a manner, that there can be no doubt of his meaning the true pancreas.—Haller quotes the very paſſage, in one part of his works, though he ſeems to have forgot it here. He ſays, "Johannes Veſlingius die 18 Januarii, 1649, lactea vaſa vidit, qua parte pancreas lieni cohæret, & qua parte ventriculus lieni incumbit." His calling them lacteals, does not in the leaſt invalidate the fact; the lacteals and lymphatics had not then been ſeparated; it was done afterwards, by Rudbeck and Bartholin.

I injected them, in 1773, from the abſorbents of the liver, contrary to the courſe of the valves, the whole length of the pancreas; they ariſe out of its ſubſtance, on its ſuperior edge, ſometimes at right angles to the principal trunk of the ſplenic plexus, which runs on the coats of the ſplenic artery; they have no centre of ramification, but come out from the lobes in ſhort branches like their arteries and veins.

The

The ABSORBENTS of the LIVER.

THERE is no part of the human body in which I have been more ſucceſsful in diſcovering the lymphatic veſſels than in the liver; and I have ſtill a manuſcript in my poſſeſſion, in which they were deſcribed, at the deſire of Dr. Hunter, in March 1773; the ſubſtance of which is as follows: — The abſorbents here divide themſelves into two ſets, thoſe which run upon the ſurface of the liver, and the deep-ſeated, which accompany the vena portarum. The abſorbents on the ſuperior ſurface of the liver ariſe in four diviſions; there is, however, conſiderable variety here, and I have occaſionally ſeen ſix, eight, or ten diviſions; I ſhall deſcribe, however, the more common appearance.—The principal diviſion commonly appears on the ſuperior ſurface of the great lobe of the liver, (I am here conſidering the body as lying upon its back) on the right ſide of the ligamentum ſuſpenſorium hepatis. It conſiſts commonly of a number of parallel trunks, which are ſometimes more evident on the ligament itſelf than on the liver. One of theſe trunks, however, is larger than the reſt, and receives the ſmaller abſorbents, as the trunk of a tree would receive branches; theſe are joined commonly by another plexus from the ſuperior ſurface of the left lobe of the liver, and which run on the ſide of the ſuſpenſatory ligament oppoſite to the former. From both of thoſe plexuſes I have injected the deep-ſeated abſorbents, by veſſels which went off from them, and entered the ſubſtance of the liver through the hole by which the remains of the umbilical vein of the fœtus paſſes in the adult. The trunks of the two plexuſes run along the ſuſpenſatory ligament from below upwards; when they come to the diaphragm they perforate it, and paſs into glands which are ſituated on the fore part of the pericardium, formerly deſcribed. Here they are joined by other trunks from the liver, to be preſently deſcribed; and from theſe glands a large trunk emerges, which running under the ſternum, between the laminæ of the anterior mediaſtinum, commonly joins the thoracic duct near its termination, but which not unfrequently communicates with the trunk of the right ſide. I believed that I was the firſt diſcoverer of this trunk; but I find, that in quadrupeds at leaſt, I was anticipated, both by Nuck and Rudbeck. On

their

their authority, Haller ſays, " Alia a ſepto tranſverſo ejuſque convexa facie, retro ſternum adſcendentia per glandulas mediaſtini, ad eas uſque quæ ſuprema ſunt."—Rudbeck has actually delineated this trunk, in his book on the lymphatic veſſels. Haller ſays, " Magnum ibi ductum pingit, pene ſimilem thoracici huic fere ſummo inſertum."—Nuck's words are, " Diaphragmatis pars convexa plurimos emittit ductus lymphaticos, qui coeuntes ſimplicem & aliquando duplicem in quovis latere componunt ramum aſcendentem ſub ſterni muſculo triangulari extenſi glandulas ſubingrediuntur ad ſuprema ſterni locatas, &c."—From Haller's authority, I find that Eſchenback has publiſhed, in German, the ſame appearances. " Inſignia vaſa lymphatica ad ductum thoracicum retro ſternum adſcendere vidit, cumque iis ea quæ a convexo hepate veniunt." The abſorbents from the ſuſpenſatory ligament of the liver do not always perforate the diaphragm, or do not perforate it at the ſame place. I have ſeen a very large trunk run from the ſuſpenſatory ligament to the left ligament, on the under ſurface of the diaphragm, between it and the ſmall lobe of the liver, and which, joining the trunk on the left ligament, to be afterwards deſcribed, went with it at that place through the diaphragm. I have alſo ſeen this trunk, after it reached the left ligament of the liver, run under the diaphragm, without going through it, to be inſerted into the thoracic duct, near the cæliac artery. I have alſo ſeen the abſorbents on the ſuſpenſatory ligament form two great trunks, equal in ſize to the middle part of the thoracic duct itſelf; theſe paſſed between the diaphragm and the ſuperior edge of the liver, and ran downwards on the under ſurface of the diaphragm, in the direction of its crura, till they came to the uppermoſt of the lumbar glands; through theſe they paſſed into the duct.

The next diviſion of the abſorbents, from the convex ſurface of the liver, lies on the right ſide of the great lobe; it forms ſometimes the principal trunk, and, whether it forms the principal trunk or not, is hardly ever wanting. When it is largeſt, it ariſes ſometimes as low down as the middle of the lower edge of the right lobe, from thence it runs obliquely upwards, in the direction of the right ligament of the liver; in its way it receives innumerable ſmall branches, and very frequently even conſiderable trunks. I have ſeen, ſometimes, almoſt the whole convex ſurface of the right lobe covered with

with its branches. When it comes to the right ligament, it penetrates the diaphragm, and, appearing on its upper ſurface in the cavity of the thorax, it takes the circular ſweep of the ribs, and runs from behind forwards, to go into the glands, already mentioned, on the fore part of the pericardium, and to join the former trunks. It was in this trunk and its branches in which, ſome years ago, I found the chyle coming from the meſentery. Some of its branches, after it has perforated the diaphragm, run backwards, and, climbing over the ſide of the ſpine, are inſerted into the thoracic duct, behind the œſophagus. In its way to the mediaſtinum, the principal trunk alſo communicates frequently with others, which run with the phrenic nerves, to be mentioned hereafter. This trunk, inſtead of perforating the diaphragm, frequently runs on the under ſurface of that muſcle obliquely, in the direction of the cæliac artery, and is near it inſerted into the thoracic duct.

The next diviſion riſes from the upper ſurface of the ſmall lobe of the liver, about the middle. It alſo runs obliquely from below upwards, in the direction of the left ligament of the liver. Its principal trunk alſo perforates the diaphragm, and, taking the ſweep of the ribs, runs from behind forward, and terminates alſo in the glands, upon the pericardium, already mentioned. I have ſeen ſome branches from it alſo run backward, and terminate in glands upon the œſophagus, immediately above the diaphragm. I have ſeen other veſſels from the ſame quarter taking the ſame courſe, and paſſing under the aorta to the thoracic duct. While I was injecting the abſorbents on the ſmall lobe of the liver, in April 1773, the mercury entered the principal trunk, but preſently ſtopped in that abſorbent, though it continued ſtill to flow from the injecting tube. I ſuſpected, at firſt, that the quickſilver, by its weight, had ruptured the veſſels, and was running off into the cellular membrane; but in a few ſeconds I was agreeably diſappointed, by ſeeing the mercury return from ſeveral abſorbent veſſels, which were riſing out of the ſubſtance of the liver, and which, running upon the left ligament of the liver, joined the trunk I had been injecting. I afterwards ſlit open that branch of the vena portarum, which ramifies through the ſmall lobe of the liver, and found that the mercury, which had eſcaped from my ſight during the injection juſt mentioned, had been filling the deep-ſeated abſorbents, which were now ſeen running in great numbers on the outſide

of the branches and part of the trunk of the vena portarum, and that it was from theſe deep-ſeated ones that the ſuperficial branches on the left ligament had afterwards been filled.

The deſcription I have given of the abſorbent veſſels on the convex ſurface of the liver, is that of their uſual appearance; but I have often ſeen ſix, eight, or ten ſmaller trunks running upwards, towards the diaphragm, between the right ligament and the ſuſpenſory ligament, and four or five others, in the ſame ſituation, between this laſt ligament and the left one. Theſe ſometimes perforate the diaphragm, and, joining ſome of thoſe on its upper ſurface, form a plexus, which runs with the mammary arteries and veins of each ſide, under the cartilages of the ribs, paſſes through ſmall glands in the courſe of thoſe veſſels, and terminates at laſt, thoſe of the left ſide in the thoracic duct, thoſe of the right ſide in the ſecond trunk of the abſorbents. They are alſo ſometimes joined by trunks from the glands on the pericardium, already deſcribed.—The abſorbents on the under ſurface of the liver ſeldom put on any very regular appearance; and when they are ſeen upon the ſurface, and are injected, they are quickly loſt in the deeper-ſeated ſet. One plexus, however, I have obſerved pretty conſtant; it begins on the lower edge of the great lobe of the liver, near the fundus of the gall-bladder; it runs over all that part of the gall-bladder which is turned from the liver, that is, the whole of its under ſide, from its fundus to its neck; and I have ſometimes ſeen that ſide of the gall-bladder entirely covered with abſorbents. When I injected theſe with quickſilver, they paſſed at laſt through glands ſituated at the neck of the gall-bladder, afterwards through other glands, lying on the trunk of the vena portarum, from whence they paſſed into the thoracic duct, behind the pancreas. It was here that I found, on examination, that I had injected, contrary to the courſe of the valves, the abſorbents of the ſpleen and pancreas, through the whole length of the latter nearly.—This plexus of abſorbing veſſels I have uſually diſtinguiſhed by the name of *plexus cyſticus*.—The deeper-ſeated abſorbents accompany the vena portarum every where through the liver, and in quadrupeds appear to be the principal plexus; yet in the human ſubject the deeper-ſeated ones anaſtomoſe ſo much with the ſuperficial ones, which I have already deſcribed, that I am confident the greateſt part of the lymph of the liver

paſſes through them.—The deep-ſeated plexus, as it comes out of the gates of the liver, I have called *plexus portarum*; it conſiſts of a great number of abſorbent veſſels, which paſs into glands upon the trunk of the vena portarum, which afterwards form trunks, which are inſerted into the thoracic duct, near the origin of the ſuperior meſenteric artery.—This plexus is very well deſcribed by Haller: "Abeunt in faſciculum vaſorum numeroſorum, qui adit glandulas conglobati generis quæ in faſciculum vaſorum hepaticorum per portas cuntium ſe immiſcent, & veſiculæ felleæ cervici etiam adſident. In cane & in capra manifeſtum plexum pellucidum vidi, in gazella pariſini, alii in aliis animalibus. Eadem trans pancreas arteriam meſentericam ad aortam uſque ſequuntur, & uno pluribuſve ductibus, in ſeruntur veſiculæ chyli, ductuive thoracico, commiſta cum vaſis lacteis ſecundi generis, aut ſupra eadem."

From the deſcription I have given, and from the annexed engraving, it will appear, that the liver has a greater number of abſorbents than any viſcus I have yet deſcribed. I have ſaid, that the abſorbents are at leaſt double of the arteries and veins. Now the liver is one of the moſt vaſcular parts in the body; it was for this reaſon that the ancients conſidered it as the fountain of the blood; it was this made Aſellius precipitately conclude, that the lacteals were carrying the chyle to the liver, that it might there be converted into blood. But if the blood-veſſels are ſo numerous, and if the abſorbents are at leaſt double their number in other parts of the body, it is not aſtoniſhing that they ſhould be ſo numerous here. We do not know the whole functions of the liver; we know that its principal uſe, in the adult, is to ſecrete the bile; but then in the fœtus it occupies the greater part of the cavity of the abdomen, when the bile is but little wanted, and a conſiderable portion of the blood, returning from the placenta, circulates through its ſubſtance; it occupies a leſs ſpace, in proportion, in the cavity of the abdomen as the body grows up, and it is more than probable that it performs ſome function not yet underſtood. Till that function is underſtood, the whole of the office of the abſorbents of the liver cannot be explained. In all other reſpects, they perform the ſame offices here as in other parts of the body.

The ABSORBENTS of the DIAPHRAGM.

THESE are ſo blended with the abſorbents of the liver, that it was not poſſible for me to deſcribe the one without the other. Accordingly, I have been in the habit of diſtinguiſhing them by names ſo compounded as to intimate this connection. Thus the trunk of the abſorbents, on the right ligament of the liver, I have named *hepato-phrenicum dextrum*; that on the left ligament, *hepato-phrenicum ſiniſtrum*; and thoſe on the ſuſpenſory ligament, *hepato-phrenica media*. Thoſe which run with the mammary arteries and veins may be termed *hepatis mammaria dextra* and *hepatis mammaria ſiniſtra*. I have alſo ſeen other trunks from the liver perforating the diaphragm, going into glands on the right and left ſides of the pericardium, and afterwards aſcending on each ſide of the phrenic nerves; theſe may be diſtinguiſhed by the name of *comites nervi phrenici*. Thoſe of the right ſide terminate in the ſecond trunk of the abſorbents, thoſe of the left ſide in the thoracic duct.——The abſorbents of the diaphragm are exceedingly numerous, and enter ſome one or other of theſe trunks, and are ſeen principally on its upper ſurface; there are others, however, on its under ſurface, which I have alſo ſeen accompanying the phrenic arteries, which may be termed *phrenica inferiora*.

The ABSORBENTS of the HEART.

THOUGH I have divided the abſorbents of the viſcera into two ſets, a ſuperficial and deep-ſeated, it was only in order that the reader might find them out more eaſily; for, in reality, there is no diſtinction in nature, and they all ariſe at firſt from the deep-ſeated parts. I ſhall, therefore, having premiſed ſo much, deſcribe thoſe abſorbents of the heart which lie upon its ſurface.—Haller, in the firſt volume of his Phyſiology, ſpeaking of the lymphatics of the heart, uſes the following words, " Quin adeo in homine, vaſa pellucida in corde inveniantur, minime

minime dubito etſi neque vidi, neque ill. Senac." But in his fourth volume he ſays, "Ipſo tamen in corde, vaſa lymphatica vidi, principe muſculo." He had, therefore, ſeen them in the interval between the writing of the one volume and the other.—Mr. Hewſon, conſcious that he alſo knew nothing of them, refers his readers to Nuck; whoſe deſcription of the lymphatics of the heart, as taken from a quadruped, without acknowledging it, has made his whole work on this ſubject ſuſpected. Mr. Hewſon ſays, "Theſe lymphatics from the anterior part of the lungs are probably accompanied by thoſe of the heart, which are repreſented by the accurate Nuck, in his Adenographia, fig. XLI."—When Haller ſays, in his fourth volume, that he ſaw the lymphatics of the heart, it muſt have been in the heart of a quadruped; for he ſays, even in his laſt edition of his Phyſiology, printed in octavo, at Lauſanne, "Et ego in vivente capilla, ſub aure ſiniſtra, vera & valvuloſa lymphatica vidi." And in the ſame ſection he ſtill ſays, "Neque ab humano corde ejuſmodi venas abeſſe probabile ſit;" and concludes the ſection, as in the former edition, "Quin adeo in homine vaſa pellucida in corde reperiantur, minime dubito, etſi neque ego vidi, neque ill. Senac, neque nuper cl. Gulielmus Hewſon."—The fact is, the abſorbents of the heart are very eaſily diſcovered, even by the naked eye, previous to injection; but, on macerating the heart in water for ſeveral days, ſhew themſelves ſtill more diſtinctly; for an elaſtic vapour, let looſe into the cellular membrane from putrefaction, and which puts on the appearance of air, enters the mouths of the abſorbents, and, paſſing along their branches and trunks, diſtends them to the utmoſt. Nothing more is neceſſary than to make a puncture in the extremity of the principal trunk; the abſorbents, through its whole courſe, inſtantly expel the air, though contrary to the valves; the anatomiſt has only to introduce a tube, filled with quickſilver, into the orifice through which the air was expelled, and he will eaſily fill the veſſels that were formerly filled with air, as far as the glands themſelves, which are not ſituated upon the heart, but, as we ſhall ſee preſently, behind the middle of the arch of the aorta.—As there are two coronary arteries in the heart, one belonging to the left ventricle, and the other to the right; and as the left ventricle is three or four times thicker than the right, the left coronary is, of courſe, three or four times larger than the right. The right coronary

runs

runs between the right auricle and the pulmonary artery, whilſt the left runs between the left auricle and the pulmonary artery; the trunks of the abſorbents run with them, and bear a ſimilar proportion, as to ſize. I have been able, with injections of mercury, to cover almoſt the whole ſurface of the heart with their branches. The right coronary trunk of the abſorbents, having accompanied the right coronary artery till it comes to its origin at the aorta, then runs by itſelf over the anterior ſurface of the arch of the aorta, and, paſſing between the right and left carotids, near their origin, enters a gland a little behind that part. The left coronary trunk of the abſorbents is formed by two great branches; one of theſe ariſes near the apex of the heart, and runs in a groove exactly over the ſeptum ventriculorum, on the ſuperior ſurface of the heart. The other ariſes likewiſe near the apex of the heart, but on the oppoſite ſide, runs at firſt in a kind of groove between the two ventricles, and, having reached the interſtice between the auricles and the ventricles, makes a ſemicircular turn from below upwards and inwards, and, having joined the other branch near the origin of the left coronary from the aorta, the trunk which they have compoſed paſſes under the pulmonary artery till it comes to its bifurcation; it then runs up in the angle between its two crura, and, running upon the poſterior ſide of the middle of the arch of the aorta, enters a gland between it and the root of the trachea. At this place the glands belonging to the heart and to the lungs are, in ſome meaſure, blended together, and the trunks ariſing out of them do not belong wholly to the heart, but alſo to the abſorbents of ſome part of the lungs. The trunk correſponding to the right coronary paſſes over the trachea, in the poſterior mediaſtinum, to join the trunk of the abſorbents on the right ſide of the neck. The trunk correſponding to the left coronary paſſes alſo with the trachea, and joins the thoracic duct, near its inſertion. Sometimes both of theſe trunks paſs into glands in the neck before their inſertion into the great trunks; but in the fineſt injection I ever made of them, they terminated immediately in thoſe trunks of the ſyſtem. There is very frequently a third trunk, belonging to the left ventricle of the heart; it runs in the middle, between the two former, and joins them, as they are paſſing under the left auricle.

The

The ABSORBENTS of the LUNGS.

NEXT to the liver, the lungs are that part of the body in which I have found the greateſt number of abſorbent veſſels. Rudbeck appears to have been the firſt who had ſeen and delineated the abſorbents of the lungs; from the figure, however, it could only be one of the trunks coming out of their ſubſtance, and running to the root of the lungs, which he had ſeen. After him, Willis, in his Pharmaceutice Rationalis, publiſhed in 1675, having deſcribed the blood and air veſſels of the lungs, ſays, "Huic vaſorum prædictorum, quibus aer & ſanguis convehuntur, triumviratui lymphæductus aquam exportantes adjunguntur. Horum ingens ſatellitium, per pulmones depoſitum, arterias & venas ſtipat: ſurculi omnes; a pulmone exteriore, verſus radices ejus tendentes, in plures truncos majores coëunt, qui, ductui thoracico communi inſerti, lympham, à ſanguine & humore nerveo ſuperfluam, ingerunt." He does not ſay from what animal his figure is taken; but, from what he ſays in the ſame chapter, one is led to ſuppoſe that it is the dog. "Hæc vaſa," ſays he, "pulmonum lymphica optime conſpiciuntur, ſi inter canem vivum diſſecandum, ductus thoracici ſummitatem, ut nihil vena ſubclavia infundatur, comprimas: tunc enim pulmonum lymphæductus, ſiquidem in commune receptaculum obturatum ac repletum ſeſe exonerare nequeant, ſummè intumeſcunt, & valde conſpicui fiunt."

Winſlow cautions us, not to take the appearance of the inflated cellular ſubſtance, interpoſed between the conſtituent lobules of the lungs, for lymphatics; "Dans la ſurface du poumon de l'homme, entre la tunique interne & la tunique cellulaire, on découvre des traces ſemblables à celles des vaiſſeaux lymphatiques; mais il ne faut pas ſe méprendre en voyant paroître ſur la ſurface du poumon un raiſeau très-tranſparent, après qu'on a fortement ſoufflé dans un lobe; car c'eſt l'air qui a paſſé au travers des cellules ou veſicules bronchiales dans les cellules interlobulaires, qui a fait un écartement de pluſieurs petits lobules, & s'eſt logé dans les interſtices de cet écartement. Les vrais vaiſſeaux lymphatiques du poumon ſont plus viſibles dans les animaux. J'ai vu dans le cheval un vrai vaiſſeau lymphatique ramper tout le long d'une grande portion

portion de l'un des bords du poumon." Accordingly Haller, ſpeaking of Ferrein's deſcription of thoſe veſſels, ſays, "Fuſius hæc ill. viri vaſa lymphatica, & ex homine deſcribuntur." And afterwards he ſays, "Dicuntur in rete coire, ſequens ſpatia inter lobulos poſita, totque retia eſſe, quot lobuli, p. 74. ubique vero æque ampla eſſe, abſque ramis, & valvulis; & ex profunda pulmonis compage radiculis ſuis naſci: quolibet rete aliud contineri. Hæc deſcriptio mire ſpatia celluloſa refert." The abſorbents of the lungs are alſo divided into two ſets, a ſuperficial and deep-ſeated. The ſuperficial ſet, like thoſe of the other viſcera, are not always to be found. I have been able, at one time, to cover the whole external ſurface of the lungs with the abſorbents I had injected; at another time I have not been able to find one. The ſame thing I have known happen frequently in the liver. One of the eaſieſt methods of finding them, is to inflate the lungs of a ſtill-born child from the trachea; the air paſſes inſtantly from the air-cells, and fills particularly the ſuperficial abſorbents; if a puncture is then made with a lancet into any one of thoſe abſorbents, the air will eſcape, and quick-ſilver may then be injected in its place, as the valves hinder it from eſcaping into the air-cells. One of the moſt perfect preparations I ever made of the abſorbents of the lungs, was in this way. Winſlow's obſervation, reſpecting the appearance of the cellular membrane forming areolæ, which ſurround the ſmaller lobes of which the lungs are compoſed, and which communicate with one another, and when inflated reſemble lymphatic veſſels, is perfectly juſt: if a puncture is made with a lancet, not ſufficiently deep, between the areolæ, and air is thrown in at that puncture, the appearance he deſcribes is conſtantly produced; but if the lancet is puſhed a little deeper, an opening will commonly be made into an abſorbent, and if air is thrown into that opening, an appearance not unlike the former will be produced, but which, notwithſtanding, is the real appearance of the abſorbents. When mercury is thrown into thoſe veſſels, it diſcovers at firſt a coarſer net-work in the interſtices of the ſmaller lobes, "vaſa concatenata reticulum facientia," as Haller expreſſes it; but if a ligature is made on the trunks of the abſorbents at the root of the lungs, and the injection is puſhed to the utmoſt, another net-work is diſcovered within the former, immenſely delicate and fine; and the whole ſurface of the lungs may, in this way, be

be covered with abſorbents. It has been ſaid by ſome, that the abſorbents here have no valves: this aſſertion is not true. The ſame remark has been made with regard to the ſmaller abſorbents on the ſurface of the liver, but is equally ill founded; the anaſtomoſes between the branches is ſo great, that the moment the quickſilver enters one of the larger veſſels, it is ſeen running in every direction: but this is not owing to the want of valves, but to the circumſtance I have already mentioned: beſides, the valves in the ſmaller branches do not ſo accurately ſhut the cavities of the veſſels as in the larger branches. The ſuperficial abſorbents terminate at laſt in glands at the root of the lungs, where they are joined by the deeper-ſeated abſorbents. Theſe laſt ramify through the lungs in the ſame manner as the pulmonary artery and veins, and cling to their coats; but are found in greater numbers on the outer ſurface of the branches of the trachea. Theſe I have conſtantly injected from the ſuperficial abſorbents; indeed it is hardly poſſible, either here or in the liver, to inject the ſuperficial abſorbents, and not to inject, at the ſame time, the deep-ſeated ones. From the glands at the root of the lungs, trunks, correſponding to both ſets, ariſe. In the left lobe of the lungs, ſeveral trunks unite, and form a very large one, which I have ſometimes ſeen equal to an ordinary gooſe-quill in diameter; this is inſerted into the thoracic duct, immediately behind the bifurcation of the trachea. Another trunk runs up on the poſterior part of the trachea, between it and the œſophagus, and terminates in the thoracic duct near its inſertion. A third trunk joins thoſe glands in which the abſorbents of the heart terminate, and is inſerted at laſt as they are. The abſorbents of the right lobe of the lungs alſo form three and ſometimes four trunks, as they emerge from the glands placed at the root of the lungs; one of theſe trunks runs upwards over the anterior ſurface of the cava ſuperior, and, having formed in its courſe numberleſs and moſt elegant convolutions, terminates at laſt in the ſecond trunk of the abſorbent in the right ſide; another, after forming ſimilar convolutions, paſſes alſo into the thoracic duct, behind the bifurcation of the trachea; a third, without forming any convolutions, paſſes with the trunk of the vena azygos, and is inſerted into the duct near the origin of that vein. I have ſometimes ſeen a fourth trunk, which ran downwards, and was not inſerted into the thoracic duct till it reached the diaphragm. Some of

the abſorbents of the right lobe almoſt conſtantly communicate with that trunk of the left lobe, which I deſcribed as paſſing behind the trachea.

The abſorbents of the lungs are exceedingly numerous, for the ſame reaſon as thoſe of the liver. I have frequently covered the whole ſurface of the lungs, in the fœtus, with abſorbents filled with air, by blowing into the trachea; I have afterwards diſlodged this air by punctures, and made quickſilver take its place. The velocity of the blood through the lungs, according to Dr. Hales's calculation, is at leaſt five times greater than that in moſt other parts of the body; if abſorption here takes place in a ſimilar proportion, it will be greater than in any other part of the body: if the abſorbents here take in noxious miaſmata from the atmoſphere, a greater accumulation of theſe will take place in the lungs, and their firſt action will be on this viſcus, and perhaps may induce conſumptions. I have ſeveral times known breathing putrid air produce pulmonary conſumption; and I am alſo convinced, that breathing the ſame air, in the apartments of conſumptive people, has infected thoſe who were obliged to be much with them. Perhaps more is to be attributed to the variable ſtate of the weather in this iſland, and to the cold and moiſture of our atmoſphere, producing debility, and occaſioning ſcrophulous inflammation of the lungs: however this may be, I know no remedy, in this diſeaſe, equal to the change of climate, and breathing purer air. I have known patients recover in Italy, and in the ſouth of France, who would have died if they had ſtaid here.

The ABSORBENTS of the Oesophagus.

RUDBECK has delineated a conſiderable abſorbent paſſing from a gland about the middle of the fore part of the œſophagus, and which, running upwards, ſoon enters the thoracic duct. This gland has been taken particular notice of by Veſalius, as having ſomething peculiar in it, and not to be found in other lymphatic glands. Vercellonius imagined, that it ſecreted a ſalt fluid, which was of uſe in digeſting our food. Morgagni reſtored it to its place amongſt the other lymphatic glands. I believe that it belongs to the abſorbents of the heart and lungs,

as

as well as to the œsophagus; nor is there one or two only, but a number of glands, in the course of the œsophagus, as formerly described. Haller says, "Earum aliqua, aut duæ, quæ magnitudine forte excellerent, tamquam solæ ea in sede essent, aut aliquid singulare haberent, pro dorsali quadam propria glandula a Vesalio descriptæ sunt: eam glandulam J. Vercellonius celebrem reddidit, cum salsum in ea, & digerendis cibis utilem succum, secerni sibi persuasisset. Verum omnino neque unica est, ut hi viri putarunt, neque duæ, aut alii, neque quatuor aut quinque, ut Whartonus & alii, sed omnino numerus & incertus est, & constanter magnus, uti recte monuit vir cl. Mauchardus. Lymphaticæ tribui vindicavit, qui tot alios errores felici ingenio profligavit, primarius professor Patavinus."—Morgagni.

I have seen the œsophagus covered with absorbent vessels from one end to the other. I have said that these absorbents are blended with those of the heart and lungs, and of the surrounding parts; but that they belong also to the œsophagus, I am perfectly certain: they arise out of it in the same manner as from other parts: nor can I conceive why Haller should express himself as he has done on this subject. He says, "Lymphaticæ venæ œsophagum numerosæ perambulant, qui totus conglobatis glandulis tegatur. Num tamen ex gula quidquam sugant, num potius ad telam cellulosam pertineant, quæ pleuræ exterior circumponitur, nunc quidem non possum definire."

In strictures of the œsophagus, I have known patients live for many months without any other nourishment than what must have been absorbed from the œsophagus, or from the inside of the mouth. In one instance, the food constantly stopped a little above the cardia, and in three or five minutes after was vomited up again, by the action of the muscular fibres of the œsophagus alone: this patient, though afterwards cured by the use of the bougie, had remained some months in the above-described situation.

The ABSORBENTS of the Intercostal Spaces.

THESE I have repeatedly injected with quicksilver from the thoracic duct, contrary to the course of the valves. I have even made the

injection paſs the ſmall glands ſituated between the heads of the ribs, and ſeen the mercury run for ſome way into the intercoſtal ſpaces through theſe veſſels; two accompany each intercoſtal artery: and on one occaſion I alſo injected their poſterior branches, which run backwards to the ſkin of the back, with the poſterior branches of the intercoſtal arteries: on this occaſion they perforated the body of one of the vertebræ of the back, through whoſe ſubſtance I afterwards ſaw them ramifying.

The ABSORBENTS of the UPPER EXTREMITIES.

HALLER ſays, that he knows little of them, unleſs the flow of lymph, which for days ſometimes follows veneſection in the arm, is to be referred to this head. "Superioris artus vaſa lymphatica—quorum in homine certa fide viſorum tenuis iterum notitia ad nos pervenit, niſi lymphæ colliquationes ex venæ ſectione natas huc referas, uti quidem referri poſſunt.

Van Horne is ſaid to have been the firſt who ſaw thoſe veſſels in the human ſubject, and that he obtained this point by making a ligature upon the arm of a young man ſome hours before his death. "In juvene poſt vincula paucis a morte horis injecta, in brachio oſtendiſſe dicitur." Nuck has repreſented them both in the upper and lower extremities; but, beſides that he has, in another part of his work, ſubſtituted the heart of a quadruped, with the abſorbents on it, in the place of the human heart, which of courſe makes his account of them ſuſpicious, the veſſels he has repreſented on the extremities are not like any thing I have ſeen. It appears alſo, that Hagen ſaw theſe veſſels very diſtinctly in an œdematous arm. "Deinde," ſays Haller, "Cl. Hagen in brachio œdematoſo vaſa lymphatica, eaque prægrandia & flexuoſa, vidit." The abſorbents of the upper extremity, like thoſe of the lower, divide themſelves into two ſets, a ſuperficial and deep-ſeated. The ſuperficial, run with the cutaneous veins; the deep-ſeated, accompany the arteries. The cutaneous veins form two great trunks in the arm; of theſe the baſilic is the principal. The greater number of the ſuperficial abſorbents accompany

accompany this vein: they ariſe from the palm of the hand, and from the back of the hand on the ſide next the little finger; they run at firſt with the veins named ulnaris externa & interna of Winſlow. I have injected theſe with quickſilver, in the human ſubject, to the number of ten or twelve. Afterwards they join the trunk of the baſilic; they ſometimes paſs into glands ſituated upon the brachial artery, near the internal condyle of the humerus; ſometimes they do not paſs into the glands till they come to the middle of the humerus, and ſometimes not till they come to the axilla: they are very much ſpread out on the fore-arm, and occupy a ſpace from three to four inches in breadth; but when they come to the humerus, they come nearer one another, and lie cloſe upon the baſilic. Haller ſays, "Hæc brachii vaſa aliquando in venæ ſectione pertuſa, moleſtiſſima & diuturna lymphæ profluvia faciunt, quale & ipſe vidi." I have never ſeen any ſuch flow of lymph from bleeding in the arm. When ſtudents of anatomy have happened to wound themſelves, in diſſecting the dead body, either on the little or ring finger, the red lines, which appeared in conſequence of this, conſtantly took the courſe I have now mentioned. Mr. Hewſon appears to have been leſs ſucceſsful in his diſcoveries here than in the lower extremity; which may account for Haller's expreſſion, "tenuis notitia." I have injected other abſorbents, ariſing alſo from the palm of the hand, on the ſide towards the thumb, which ran on both ſides of the flexor palmaris muſcle, and, at the bending of the joint between the arm and fore-arm, joined the plexus laſt deſcribed, but did not paſs into any glands till they came to the axilla. The abſorbents which accompany the cephalic vein, ariſe from the ſides of the thumb and fore-finger, upon the back of the hand; they run at firſt with the vein called by Winſlow the radialis externa, but at the bend of the arm join the cephalic, with which they run upon the outer edge of the biceps flexor cubiti; they run in this direction for ſome way, but ſoon get between the inner edge of the deltoide and outer edge of the pectoralis major, after which they paſs under the clavicle, and are inſerted into glands upon its inſide.

There are other abſorbents on the back of the hand, on the ſide next the little finger, which turning round with the ulnaris externa, are inſerted at laſt into a gland almoſt conſtantly to be found upon the anterior ſurface of the inner condyle of the humerus: from this gland a very large

vas

vas efferens goes out, which almoſt immediately joins the brachial artery, and then ſplitting into two, accompanies it all the way to the axilla; and its branches are inſerted into the axillary glands. If venereal matter is abſorbed any where from the hand, near the little or ring finger, or from thoſe fingers themſelves, the gland on the internal condyle of the humerus, or ſome one in the courſe of the brachial artery, will moſt probably inflame, and form a buboe, and the intelligent practitioner will be warned of this abſorption; but if the venereal matter is abſorbed from the thumb or fore-finger, or from the hand in their vicinity, it is poſſible that it may not paſs into any glands, until it comes into the inſide of the clavicle; theſe are out of the reach either of our ſight or feeling, and the patient may be infected, without the practitioner's having even ſuſpected it.

The deep-ſeated abſorbents of the arm accompany the arteries in the ſame manner as the veins do, two with each artery. I have ſeen two with the radial artery, two with the ulnar, two with the internal interoſſial, and I have already deſcribed two with the brachial artery; theſe at laſt all terminate in the glands of the axilla: from theſe glands conſiderable veſſels go out, which at laſt uniting, contribute to form, in the right ſide, one great trunk, which I have already called the ſecond trunk of the abſorbent ſyſtem; and in the left ſide form a trunk, which either joins the thoracic duct near its termination, or is inſerted by itſelf into the ſubclavian vein adjoining.

The abſorbents from the muſcles and integuments on the poſterior part of the ſcapula, alſo terminate in the axillary glands; I have frequently injected them from thoſe glands, contrary to the valves. Haller, apparently quoting from Mr. Hewſon, ſays, "Ad glandulas demum axillares veniunt—ibi conjunguntur cum vaſis profundis, arteriam radialem & procul dubio ulnarem & interoſſiam comitantia."

The ABSORBENTS of the THYROIDE GLAND.

THE trunk of the abſorbents in the right ſide, and the thoracic duct in the left ſide, are joined near their termination by two trunks from the thyroide gland. I have frequently inflated thoſe trunks, by plunging a

lancet at random into the ſubſtance of this gland, and throwing in air or quickſilver, as we generally do in abſorbent glands; a method firſt practiſed by Mr. Hunter. Haller has alſo ſeen theſe veſſels; and ſays, "Numeroſa etiam vaſa aquoſa ſunt thyroideæ glandulæ."—There is not any part of the body more vaſcular, in proportion to its bulk, from arteries, veins, and abſorbents, than this gland; but, as I have not the leaſt conception of its uſe, I do not underſtand what functions in particular its abſorbents perform.

The ABSORBENTS of the THYMUS GLAND.

THESE I never looked for, as it is a part which does not exiſt in the adult body, and is chiefly connected with the fœtus. Haller mentions its abſorbents, on the authority of Pauli; and, ſpeaking of the abſorbents of the neck, and their termination, ſays, "Non ſine aliqua a thyma advenientium vaſculorum acceſſione."—I know not the uſe of this gland; of courſe, not the particular uſe of its abſorbents. It reſembles, according to Haller, the abſorbent glands of the meſentery, in containing a ſimilar globular fluid as they do, and in diſappearing at laſt entirely: but there is certainly a very material difference; the thymus, at, or ſoon after birth, is larger than all the abſorbent glands of the meſentery taken together; it does not at all reſemble them; and diſappears totally about twelve or fourteen years of age. The lymphatic glands of the meſentery, if they diſappear at all, are, at leaſt, viſible on the meſentery at ſeventy, and even eighty years of age.

The ABSORBENTS of the HEAD.

HALLER ſays, "In capitis equidem regione ſubcutanea vaſa lymphatica paſſim reperiuntur, & mihi in facie, maſſetere muſculo, parotide, margine nudo maxillæ inferioris, etiam in homine innotuerunt; in brutis animalibus utique notiora."—Speaking of thoſe in the brain itſelf, he ſays, "Lymphaticorum vaſorum in cerebri equidem interiori regione

regione poſitorum nonnulla paſſim veſtigia reperiuntur. In cerebri ventriculis, glandula pituitaria, & infundibulo, apud Marchettis. In cerebro & plexu choroideo apud Ridley, ipſumque Nuckium. In dura matre, ad glandulas ſinui falciformi adſidentes, nuperus apud Danos proſector. In pia matre alii ſcriptores, Lanciſius, Pacchionus, & Fantonus, & in comitatu nervorum olfactoriorum verſus nares B. Carr, in Epiſtola Leidæ impreſſ. anno 1683. Verum dudum de his per cerebrum lymphaticis vaſis dubia moverunt viri inſignis his in rebus auctoritatis Brunner & Zellerus, neque unquam aliquid ſimile vidi; & obeſt quod nullæ intra cranii caveam glandulæ lymphaticæ reperiantur, quales a ductibus aquoſis non longe abeſſe ſolent."—I have doubts, as well as Haller, of the deſcriptions given by theſe anatomiſts of the abſorbent veſſels of the brain; not that they do not exiſt: but there are ſo many appearances in the brain, perſons not accuſtomed to the injecting abſorbents might miſtake them; it is a viſcus which ſo ſoon becomes putrid, that we cannot truſt to the gradual extrication of fixt air, as in other parts, for the diſcovering of theſe veſſels; and they muſt alſo be ſo tender, as every part of the brain is, that they will hardly bear a column of quickſilver without preſently burſting.—The circumſtance urged by Haller, of there being no lymphatic glands within the cranium, is not material. There are none on the legs or fore-arms, yet there are a vaſt number of abſorbents. There are none on the outſide of the cranium, above the mammillary proceſſes, yet the abſorbents are as evident and numerous as in any part of the body.—I ſhall relate what I know, and have ſeen, reſpecting the abſorbents of the head.

They form two ſets; one of which lies upon the outſide of the head, and the other belongs to the brain. The firſt, acccompany the temporal and occipital arteries. Thoſe accompanying the temporal artery terminate in glands under the zygomatic proceſs; whilſt thoſe accompanying the occipital artery terminate in glands ſituated on and behind the mammillary proceſſes of the temporal bone. From theſe the abſorbents of the neck may be very readily injected.—There is the appearance of abſorbents on the ſurface of the brain, between the tunica arachnoides and pia mater. Ruyſch was the firſt who obſerved this; he has given an engraving of them, inflated with air, and calls them vaſa pſeuda lymphatica. I have repeatedly injected them with quick-

ſilver;

ſilver; but, as they appear to me to be deſtitute of valves, the great characteriſtic of abſorbent veſſels, and as I have not yet traced them to the glands, I have not yet determined what they are. They may be abſorbents without valves, as the fluids, coming from the brain, have the aſſiſtance of their own gravity in deſcending, and the valves would have been of no uſe in veſſels not expoſed to the contraction of ſurrounding muſcles. — That the brain has abſorbents, I am perfectly certain; for I have ſeen abſorbent glands in the foramen caroticum, which, from this ſituation, could not belong to any veſſels but ſuch as were coming down from the brain. From theſe glands the deep-ſeated abſorbents of the head go into other glands, in the courſe of the internal jugular veins and carotid arteries; and, having been joined by thoſe from the outſide of the head, they form larger and larger trunks as they come nearer the angle between the jugular and ſubclavian veins, and are blended with the abſorbents of the neck.

The ABSORBENTS of the FACE.

THESE I have often ſeen, in great numbers, accompanying the external maxillary artery through all its branches, coming from the inner angle of the eye, from the noſe, and from the lips. Some of them paſs through glands on the buccinator muſcle; but the larger trunks commonly paſs through glands ſituated on the baſis of the lower jaw, near the anterior edge of the maſſeter muſcle, and in the courſe of the trunk of the external maxillary artery. Haller, in ſpeaking of the abſorbents of the head, I have already ſaid, mentions thoſe of the face: "Mihi in facie, maſſetere muſculo, parotide, margine nudo maxillæ inferioris etiam in homine innotuerunt."—Thoſe from the noſe accompany chiefly the internal maxillary artery, and paſs through glands under the parotid, and in the courſe of the trunk of that artery. Thoſe from the gums, alveolar proceſſes of the teeth, and tonſils, accompany the ſame artery; but after they paſs the angle of the lower jaw, join frequently the external jugular vein, and paſs through glands on the top of the ſhoulder. Thoſe from the tongue, and muſcles of the os hyoides, alſo paſs through

the glands lying on the internal jugular vein, below the angle of the lower jaw. Haller alſo has ſeen theſe. "Alii veniunt a muſculis oſſis hyoides & pharyngis & linguæ, & ex ipſa demum lingua; hæc quidem ſatis dudum a me viſa, & a larynge denique."

The ABSORBENTS of the NECK.

THE veſſels I have now deſcribed, as well as thoſe of the head (ſtrictly ſpeaking), I have ſaid, paſs through glands in the neck; theſe I have formerly deſcribed as exceedingly numerous, and accompanying both the jugular veins and carotid arteries. The veſſels and the glands together form the grandeſt plexus of abſorbents, perhaps, in the body. The appearance of theſe veſſels of the head, face, and neck, are only expreſſed, as it were, in outlines in the annexed figure, as I have reſerved this for ſome future opportunity.—After paſſing through a number of glands on the ſides of the neck, the abſorbents form at laſt common trunks; that of the right ſide is inſerted into the ſecond trunk of the abſorbents, and that in the left ſide commonly joins the thoracic duct, near its termination. Haller had ſeen this plexus; and ſays, "Deſcendunt cum ea glandularum ſerie quæ jugularem venam ad cavam ſuperiorem comitatur.—Hæc omnia in trunculos unita cum ramis a capite deſcendentibus & comitibus ramorum arteriæ carotidis demum, &c." The abſorbents of the nape of the neck, and from the integuments and muſcles between the ſcapulæ, alſo paſs through the glands ſituated on or near the mammillary proceſſes.

CON-

CONCLUSION.

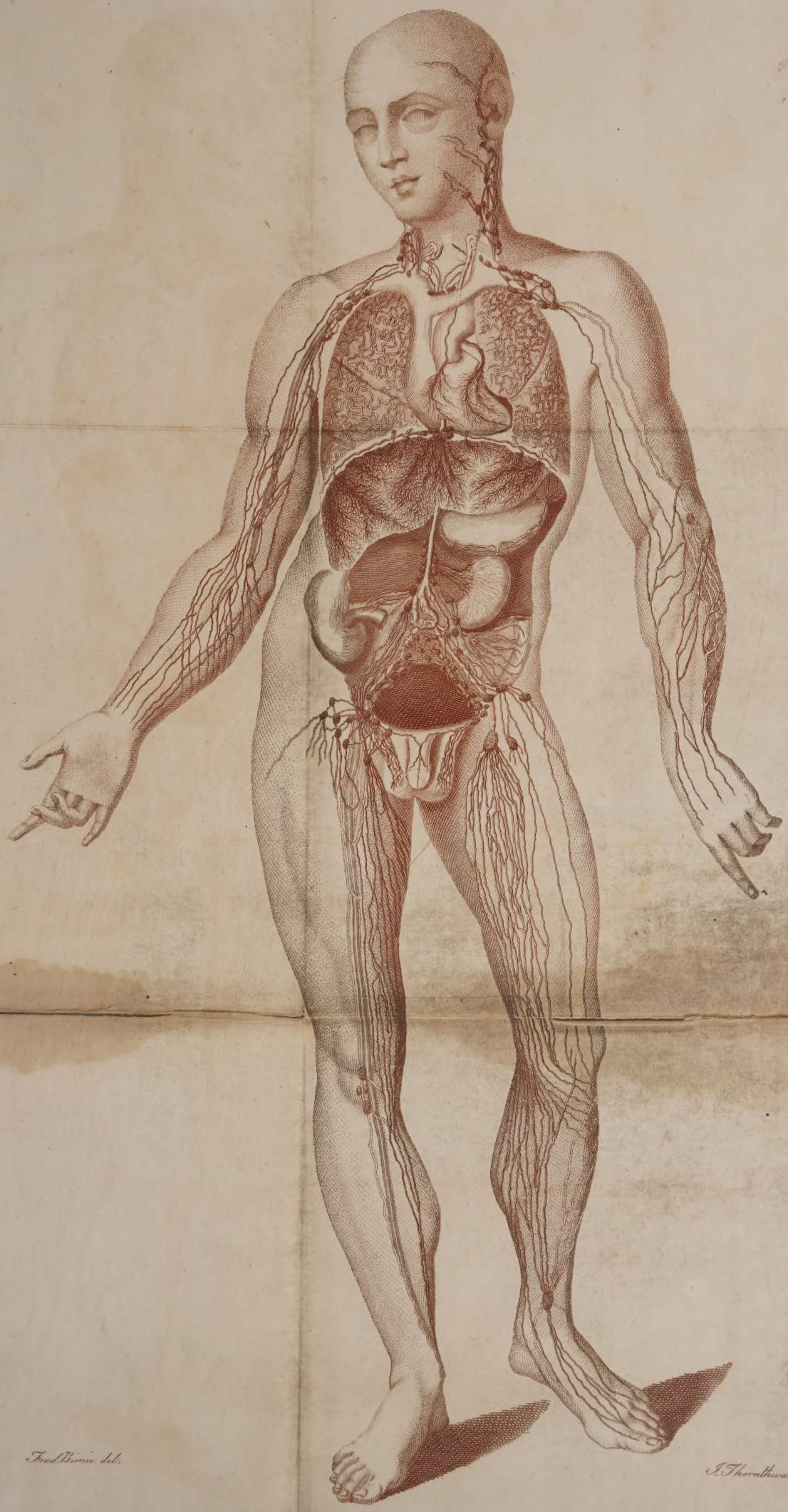
IT appears then, from the foregoing treatiſe, that the lacteals and lymphatics of the human body are not a trifling appendage of the red veins, but form of themſelves a grand ſyſtem for abſorption; and, ſo far as we have yet diſcovered them, are not only equal in number to the arteries and veins, but actually ſurpaſs them. I mentioned Haller's opinion of their inferiority; he ſaid, "Deinde fateri oportet, poſt tot induſtriorum virorum labores, fragmenta tamen eſſe ea omnia quæ de vaſis lymphaticis ſcimus, neque ullo modo cum arteriarum & venarum aut nervorum hiſtoria deſcriptiones vaſorum aquaſorum comparari poſſe."— If I have not entirely diſproved this aſſertion, I hope I have gone ſome way towards it; and I have no doubt but that the hiſtory of his vaſa aquoſa will be ſoon as complete as that of the arteries, veins, or nerves. I have not only laboured much towards the completing of this hiſtory myſelf, but I have the pleaſure to ſee it every day improving in the hands of my pupils, from whom I concealed nothing. — Maſcagni, though no pupil of mine, has deſcribed moſt of the veſſels I have ſeen, but many years after my deſcription was in the hands of medical ſtudents in general. He has alſo deſcribed ſome veſſels which I have not ſeen.

I formerly ſaid, that Mr. Hunter was the firſt who attributed the removal of the ſolid parts of the body to the action of the lymphatic veſſels: Whatever opinions I have advanced in this work, which are ultimately built on this doctrine, are originally his; ſuch, for example, as reſpect the growth and ſhape of the bones, exfoliation, ſloughing, &c.

It will appear ſtrange, that I have ſaid nothing of the uſe of the abſorbent glands. I avow abſolute ignorance of this matter. There are none in turtle, in fiſh, and only two in the necks of ſome birds. Why there are ſo many in men and quadrupeds, I do not know, nor why they

exiſt at all.——I think this confeſſion much better than to attempt an idle hypotheſis, which would convince nobody, and of which I myſelf ſhould hereafter be aſhamed. I ſhall, therefore, conclude with a quotation from Galen, who, in his book on the uſe of the parts of the human body, expreſſes himſelf to the following purpoſe: "There is a certain length to which we may carry our reſearches; but if we attempt to go beyond that, we ſhall ſoon convince ourſelves, that we neither underſtand our own imbecillity, nor the great ability of him who made us." Το δε ὅπως εγενετο τοιουτον εαν επιχειρησης ζητειν αναισθητος φωραθήση και τῆς σῆς ασθενειας και τῆς Δημιουργε δυναμεως.

EXPLA-



Fred. Bunce del.

T. Thornthwaite Sculp.

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EXPLANATION OF THE PLATES.

PLATE I.

THE GENERAL APPEARANCE OF THE HUMAN BODY, SUPPOSED TO BE IN SUCH A MANNER TRANSPARENT AS THAT I MIGHT EXHIBIT IN IT WHAT PARTS OF THE ABSORBENT SYSTEM I CHOSE.

I did not think it proper to ſpoil the figure by letters of reference.

THE left leg repreſents the cutaneous abſorbents, in the moſt ſucceſsful injection I ever made of thoſe veſſels, and is deſcribed page 135.

The right leg repreſents both the cutaneous and deep-ſeated abſorbents. They are alſo deſcribed in page 136, and following. The dotted lines repreſent the deep-ſeated abſorbents.

The abſorbents on the penis only repreſent the principal trunks and general arrangement of the abſorbents in that part, and are deſcribed page 138.

The abſorbents of the teſticle are deſcribed in page 140.

The plexus iliacus externus, and the principal trunks of the right and left leg, within the abdomen, are deſcribed page 137.

As I have given a plate of the deep-ſeated lacteals, and as the ſuperficial lacteals, and thoſe on the meſentery, have been ſo often delineated, and ſo well, by others, I have been leſs attentive to the repreſenting of them here. They are ſeen in a general way on the right and lower part of the abdomen.

I have not choſe, at preſent, to exhibit more than a ſlight ſketch of the abſorbents of the great inteſtines on the right ſide of the abdomen.

The abſorbents of the kidney are of themſelves ſufficiently evident to any anatomical reader, they are however deſcribed page 145.—Contrary

trary to my first intention, the absorbents in the substance of the kidney are represented as full of their own fluids.

The thoracic duct, at its origin, is seen on the lumbar vertebræ, and is described page 151, and following.

The trunks only of the absorbents on the great curvature of the stomach are seen on that viscus, above the kidney, and in the left hypochondrium.

On the upper edge of the liver are seen, if you carry your eye from the right side to the left, seven trunks of the absorbents, succeeding each other at small distances; the varieties of the first and last trunks, which are seen running downwards, make nine.

I did not choose to disfigure the plate by inserting the varieties of the hepato phrenica media, nor the appearance of the plexus portarum and cysticus, otherwise there would have been thirteen divisions in the trunks of the absorbents belonging to the liver.

The large vessels, with which the first seven trunks on the upper edge of the liver communicate, are the trunks of the absorbents of the diaphragm, as well as of the liver. See pages 167 and 172.

The absorbents of the heart are described page 172, and are here sufficiently distinct of themselves, without any further description.

The absorbents of the lungs also want no other description than is given in page 175.

The absorbents of the arm are described page 180, and following, and are also sufficiently distinct of themselves.

The trunks in the lower part of the neck, terminating between the jugulars and subclavians, are six in the right side and four in the left. Four of these, on the right side, emerging from the cavity of the thorax, belong to the liver, diaphragm, heart, and lungs. The fifth is the trunk from the right lobe of the thyroid gland. The sixth, on the outside of the angle, is the trunk of the absorbents of the right arm, and right side of the head.

The trunks on the left side, arising out of the thorax, are the thoracic duct, and the trunks from the left lobe of the liver, left side of the diaphragm, and left side of the heart and lungs.

The trunk from the left lobe of the thyroid gland shews itself.

The trunks of the absorbents of the left arm, and left side of the head, are not delineated.

The absorbents of the head are in outlines, as I mean to represent them particularly in a future publication.

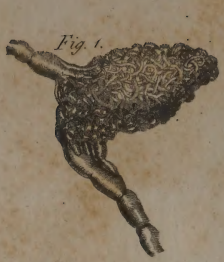
Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

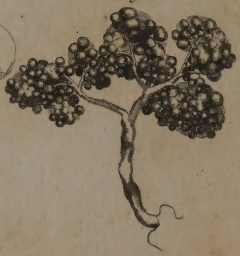
Fig. 6. a.

Fig. 7.

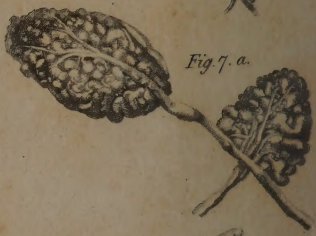
Fig. 7. a.

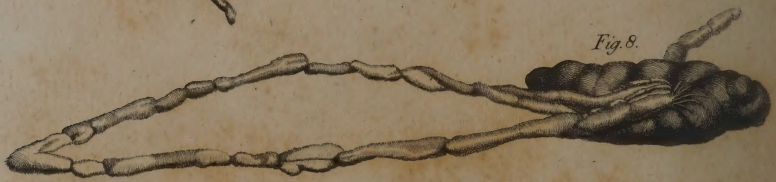
Fig. 8.

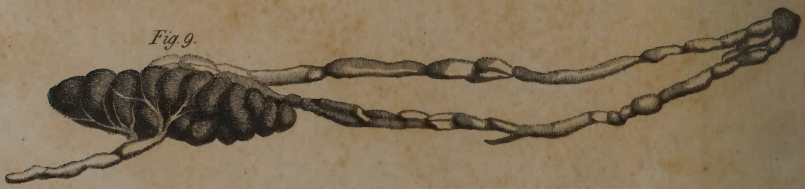
Fig. 9.

Fig. 10.

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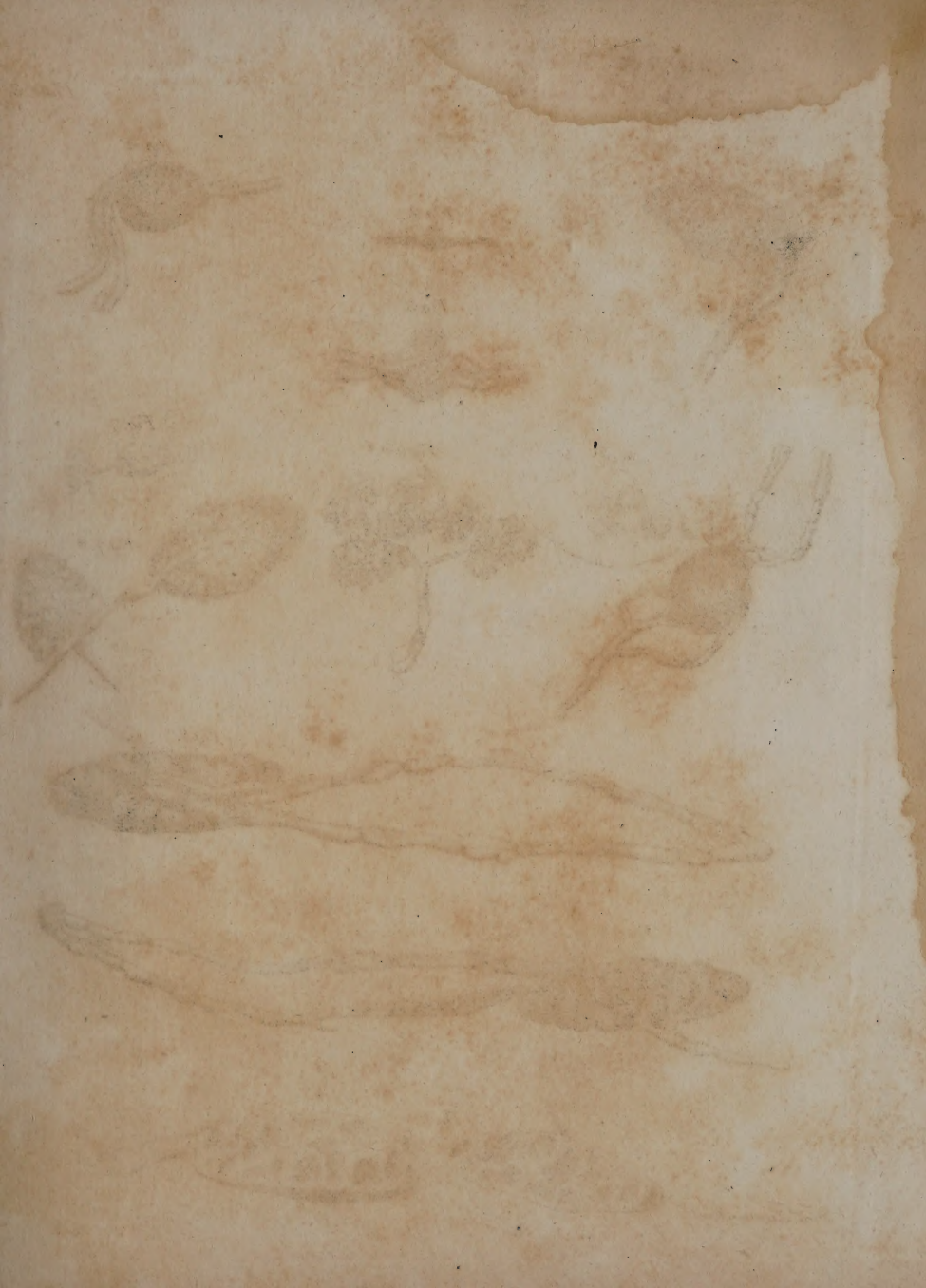


Fig. 1.

Fig. 3.

Fig. 2.

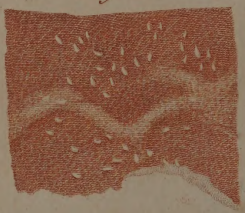
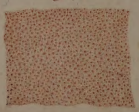


Fig. 4.



J. Thornthwaite Fecit.

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PLATE II.

Fig. 1. Repreſents an outſide view of the deep-ſeated lacteals in the beginning of the ilium, which is here ſlit open, and ſpread out. The preparation was taken from a woman who died in labour about five o'clock in the morning. The chyle had coagulated more firmly in the veſſels than I had ever ſeen it before in the human ſubject. The peritoneal, and the greateſt part of the muſcular coats, are removed, to ſhew the veſſels more diſtinctly.

a, a, &c. repreſents ſix trunks of each ſide, accompanying the principal trunks of the arteries. They are exactly double the number of the laſt.

Fig. 2. Repreſents a portion of the inſide of the ſame inteſtine, in which ſeveral villi, or packets of projecting extremities of veſſels, enveloped in productions of the inner coat of the inteſtine, are ſeen turgid with chyle, and white as ſnow.

Fig. 3. Some of theſe villi, as they appeared when viewed through the microſcope: the orifices of the lacteals, and their radiated extremities, are ſeen diſtinctly, as deſcribed page 58. The lowermoſt villus was ſo turgid with chyle that I could ſee no orifices.

Fig. 4. A portion of the ſkin of the arm, when the cuticle, rete mucoſum, and ſome other analogous membranes, were looſened by maceration, and removed by the ſlighteſt touch of the handle of the knife; where, though I could not diſcover the orifices of the abſorbents, yet the pores themſelves are ſeen more elegant than I ever ſaw them on any former occaſion. The orifices of the abſorbents, I am certain, are principally ſituated in the inſides of theſe pores.

PLATE III.

THIS IS MEANT TO EXPLAIN THE STRUCTURE OF THAT PART OF THE GLANDS OF THE ABSORBENTS WHICH IS MORE IMMEDIATELY CONNECTED WITH THE ABSORBING VESSELS.

Fig. 1. A gland injected from the abſorbents only with quickſilver, which, on its external ſurface, immediately after it was injected, put on the ſame appearances that it afterwards did when it was dried, and viewed through oil of turpentine. I could then ſee nothing but the appearance of convoluted abſorbents.

Fig. 2.

Fig. 2. A gland injected also from the absorbents only, dried, and seen through oil of turpentine; where, in the outside view, I could then see nothing but the appearance of convoluted absorbents.

Fig. 3. The same gland, as seen through the microscope, exhibiting only the former appearances.

Fig. 4. An absorbent gland also injected with quicksilver only from the absorbents, where cells were evident, both immediately after it was injected, and after it was dried, and viewed through oil of turpentine.

Fig. 5. Another gland treated in the same way, which shewed more distinctly the same appearances.

Fig. 6. A gland, one-third injected with quicksilver: the cells, not only at the time of the injection, but after it was dried, and put in oil of turpentine, were perfectly distinct.

Fig. 6. a. The last gland, as seen through the microscope, the cells now as distinct as possible.

Fig. 7. Two glands, injected in the same manner as the preceding; but, instead of being dried, and put into a vial containing oil of turpentine, were only dried and varnished. They are taken from the mesentery of an ass, and even to the naked eye appeared cellular.

Fig. 7. a. The same glands, as seen through the microscope: the cells have a different shape from those of the absorbent glands of the human subject, and resemble exceedingly the convolutions of the cortical substance of the brain.

Fig. 8. An anterior view of a gland, near the spleen of a horse, injected in the same manner as the preceding; also dried and varnished, and, after a whole year's continuance in the same situation, divided longitudinally by a very sharp knife. Before it was divided, it resembled the vesiculæ seminales, injected with quicksilver, both in its anterior view and in

Fig. 9. Which is a posterior view of the same gland.

Fig. 10. The same gland, after it was thus longitudinally divided, and that the mercury, which had so long kept its cells distended, had escaped. The cells are now seen as distinct as those of a honey-comb; with this difference, that there are lateral communications between these cells (through which bristles passed with the greatest facility) which are here represented.

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